From Microtraining and Open Educational Resources (OER) to Master Courses on Geographical Information Systems (GIS)

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Abstract

With today's rapid changes in socio-economy and technology, knowledge and learning are critical issues for most companies and private and civil service organisations. The needs for competence development range from short informal courses to formal educational programs at university level. Informal learning is less predictable. It is nevertheless a very natural way of learning, although it is often not perceived as learning. In practice, however, informal learning is considered more effective than formal learning because it is personal, real and the learner is responsible. Traditionally, universities mainly offer formal courses with credits, while the real needs are far more for informal courses on demand, flexible in time, path and pace, and with a range of complexity. Normally, it is anticipated that informal courses are offered by non-academic or private organizations.

The main objectives of the project eGIS+ (2007 – 2009) (Leonardo da Vinci, LdV pilot project, under the Lifelong Learning Program, LLP, "Transfer of Innovation", ToI) is to implement the knowledge and understanding of Geographical Information Systems (GIS) to a broad range of people in society, targeting groups such as teachers and pupils in primary and secondary schools, students and researchers within higher education, employees in private- and civil service organisations and public in general. The demand for competence development within GIS in Europe is high, with heavy demands for short courses; particularly Internet based training with flexibility in time, space, level, content and pre-understanding. The above needs comprise deeper understanding of digital mapping, database handling and tools for GIS analysis. The development and increased accessibility of public spatial databases is an incentive for increased GIS integration as GIS more and more becomes a natural part of daily work included in most fields of activities. Ten partners from eight countries in Europe participate in eGIS+. As the target groups are highly diverse, content, software, media presentations etc, will be adapted to cultural and language differences within the partnership. All educational material is available at www.e_gis.org free of charge as open resources (the social web, Web 2.0 is mainly used). Responses already show appreciation for the creative and innovative approach of the project with tasters, Microtraining, re-usable learning objects and Open Educational Resources (OER) from two minutes, two hours, two days and two weeks and up to advanced Masters Courses.

Introduction

eGIS+ is a two year pilot project (2007-2009) based on the Leonardo da Vinci Program (LdV), Lifelong Learning Programme (LLP), "Transfer of Innovation" (ToI). ToI supports projects that bring forward and improve results from previous educational projects. The objectives of the project are to further develop results from the previous Leonardo Pilot Project E-GIS [1,2]. E-GIS was developed successfully during the period 2002 – 2006. Based on experiences from this project, the aims are to target a broader range of GIS user groups, test out new Learning Management System (LMS), different media development software, translate course material into partner languages, create a larger variety of duration of course modules; modules from just a few minutes up to 10 ECTS (Table 1) and up to the Master Courses developed through E-GIS; GIS1 and 2, Specification of GIS in Organizations, GIS in Physical Planning, GIS in Resource Planning, GIS in Environmental Planning, Geographical Data Modelling and Management and Internet GIS [1,2].

The Needs for Microtraining and Open Educational Resources

Traditionally, universities mainly offer formal courses with credits, while the real needs are far more for more informal courses available on demand, flexible in time, path and pace, and with a range of complexity. Normally, it is anticipated that informal courses are offered by non-academic or private organizations.

With today's rapid changes in socio-economy and technology, knowledge and learning are critical issues for most companies and private and civil service organizations. The needs for competence development vary widely from short informal courses to formal educational programs at university level.

Informal learning is less predictable. It is nevertheless a very natural way of learning, although it is often not perceived as learning. In practice, however, informal learning is considered more effective than formal learning because it is personal, real and the learner is responsible.

The concept of Microtraining [3-5] has been introduced, and ongoing research demonstrates that a combination of short introductory topics, combined with day-to-day on-the-job working with mentors and coaches leads to effective competence updating. Consequently universities have to respond to these challenges.

The Microtraining approach has been shown to be helpful in developing learning solutions that fit existing needs. It has proved to be a very suitable method because of its emphasis on the employees' ability to train themselves, as well as on work-integrated learning. In short sessions of 15 to 30 minutes basic knowledge is refreshed and expanded. It often starts with demonstrations followed by exercises and the learner can go through the material as often as needed. Approximately eighty percent of on-the-job learning takes place in informal settings: in casual conversation with colleagues, meetings at the coffee machine, when doing jobs together, in communities of practice and when consulting experts or the Internet. Microtraining supports this unofficial, unplanned and ad-hoc learning process. The intension with Microtraining is "just-in-time" learning in the context of the tasks at hand [3-5].

The possibility for distributing knowledge and creating flexibility to a larger extent in different areas has been opened up through new technology [6,7] such as the social web (Web 2.0) [8-11] and Open Educational Resources (OER) [12-15], and the use of the Microtraining concept [3-5]. The implementation and dissemination of the project is based on the web portal, www.e-gis.org.

Paradigm Shift in Education

There is a paradigm shift in education today with some critical challenges encouraging and provoking innovation in teaching and learning. Students have changed, but a much educational material remains unchanged. Higher education is facing growing service expectations, especially for increasing its use of social computing. In particular, there are growing demands for learning materials to be delivered to mobile devices. Coming generations are increasingly demanding creativity, flexibility, new pedagogical approaches and personalized learning (such as Web 2.0). Experience with – and affinity for – games as learning tools is an increasingly universal characteristic among those entering higher education and the workforce [6, 7].

The emergence of digital native learners (New Millennium Learners, NML) has major potential implications for education. The new generation of learners' attitudes and expectations are important to be aware of and to understand. The impact of digital technologies on cognitive skills and on learning expectations, and the evolution of social values and lifestyles are important issues [6,7].

Learning resources are often considered key intellectual property in a competitive higher education world. However, more and more institutions and individuals are openly and freely sharing their digital learning resources over the Internet in the form of OER. An OECD study on e-learning asks why this is happening, who is involved and what the most important implications of this development are. The report offers a comprehensive overview of the rapidly

changing phenomenon of OER and the challenges it poses for higher education. It examines reasons for individuals and institutions to freely share resources, and looks at copyright issues, sustainability and business models as well as policy implications. The OECD report will be of particular interest to those involved in e-learning or strategic decision making within higher education, to researchers and to students of new technologies [12].

Despite the challenges of the 21st Century, many of today's schools still operate as they did at the beginning of the last century and are not encouraging the deep learning and skills that generate innovative activity. How can today's schools be transformed so as to become environments for teaching and learning that turns individuals into lifelong learners and prepares them for the 21st Century? [6,7].

OER resources [12-15] and Microtraining [3-5] are also foreseeably needed by society so that training can be provided just in time, in the right place, and with flexibility to be able to meet the demands of the individual [6,7].

Furthermore to enhance different learning styles, the concepts of Laurillard [16] has to be taken into consideration. She argues that approaches such as production, interaction, discussion, adaptation and reflection, have to be embedded in web course material depending on different learning styles for individuals [16].

GIS – GEOGRAPHICAL INFORMATION SYSTEM

Geographical Information Systems (GIS) is a computer-based tool for handling and analyzing digital map data to which are connected attribute data for statistical treatment e.g. resource - and environmental planning, pollution, transport logistics, the spreading of diseases, physical planning etc.[17-20]. According to Chrisman (2002) GIS is a system of hardware, software, data, people, organizations and institutional arrangements for collecting, storing, analyzing and disseminating information about areas of the Earth [20].

GIS are nowadays used in nearly all sectors in daily life, and used in many areas of society and with all kind of users groups, from school children using games on Internet to employees and professionals in their daily work. An interesting perspective is that many people use GIS related functions on the Internet without being aware that a knowledge of GIS lies behind those functions. The demand for competence development within GIS in Europe is high, with heavy interest in short courses; particularly Internet based training with flexibility in time, space, level, content and pre-understanding [17-20].

The new concept Geo-everything which says that everything on Earth´s Surface has a location that can be expressed with just two co-ordinates plays a new role in the GIS area and for the users. An increasing number of mobile and web-based services can respond to geo-locative data in creative and useful ways. The array of emerging web applications that combine topographical data with geo-tagged media and information are at the root of geo-location´s importance to educational practice [7].

eGIS+

Objectives of eGIS+

The need for GIS knowledge in the Lifelong Learning perspective vary with great diversity among target groups regarding previous knowledge, interests, profession, language, age and ability. Economic resources and employability are crucial. How can GIS competence developments be accomplished at reasonable cost? How should target groups with GIS competence demands be reached, no matter where they live? How can GIS courses be adapted to people who are employed or, for some reason, demand high levels of flexibility in time, place and study pace? How might interest in GIS for children and new target groups be captured? What about adapting courses for individuals with some kind of disability? These are the challenges coupled with new competence demands which are being addressed

by the eGIS+ project. Table 1 demonstrates the concept of the project, aiming to target broader user groups in society through a variety of modules, from very short introductory "tasters" up to formal 3 and 10 ECTS courses.

Table 1: Developed Course Modules in the eGIS+ Project

Course		Content
Web portal	Dissemination	A web portal, where all eGIS+ material can be available. The aim is 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 are 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 are 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: - Introductory course - GIS applications - The implications of Spatial Data Information (SDI) [21] on contemporary GIS activities in the EU
GIS study	10 ECTS	Adapting existing E-GIS courses [1,2] to open source LMS and GIS software platforms and to modernize the contents to reflect recent GIS developments in the EU.

eGIS+ develops, disseminates and valorises results from the former E-GIS project, 2002-2006 [1,2]. E-GIS experience, demonstrated new possibilities and needs for satisfying an even broader range of interested user groups. Target groups will be teachers and pupils in school, employees in private and civil service organisations, students and researchers in higher education, and public in general. The aims of eGIS+ are to develop new pedagogical approaches with mainly Web 2.0 applications [8-11] for social networking for accomplishing information and competence development. Moodle, is used as Virtual Learning Environment (VLE) with YouTube, Wikis, Blogs and re-usable learning objects [22,23] etc, which already are available mainly free of charge on the Internet. GIS resources developed through eGIS+ are available in the web portal www.e-gis.org for different target groups with different demands on pre-understanding. Information about both projects E-GIS and eGIS+ is also to be found on the portal. eGIS+ is a typical information distribution project and the web portal is one of the most important tools in the dissemination and validation process.

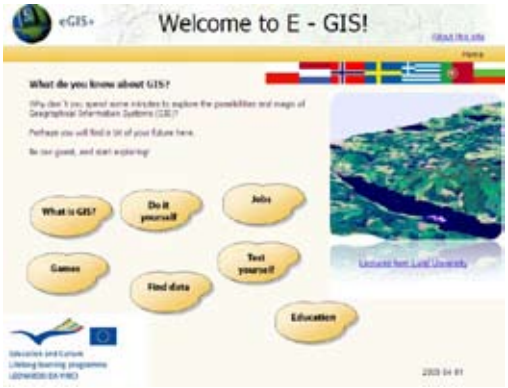
The Web Portal and its Navigation Structure

In eGIS+, the Moodle based 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 and to use it for communication between partners, tutors and students during course implementation. The portal is designed in the form of "clouds" representing areas such as; What is GIS? Games, Do it yourself, Jobs, Find data, Education and Test your GIS knowledge. There is a wide variety of information available in the portal, with presentations ranging from short modules of a few minutes , on the first level, up to a couple of hours and a few days at more advanced levels. These are presented as video clips, audio, pictures, text with local GIS examples from partner countries adapted to different target groups and at different levels. The modules will be translated to partner languages, with open access. The first level of course materials is modules which can be used for Microtraining [3-5] and as

OER [12-15]. All materials and necessary GIS software are free for use for everyone interested (end-users). The second level consists of two week (3 ECTS) courses: firstly an introduction to GIS, secondly a special subject e.g. archaeology, and thirdly covering the implications of Spatial Data Infrastructure (SDI) [21] on contemporary GIS activities in EU. The third level provides revised GIS modules from the previous E-GIS (10 ECTS) courses (Table 1).

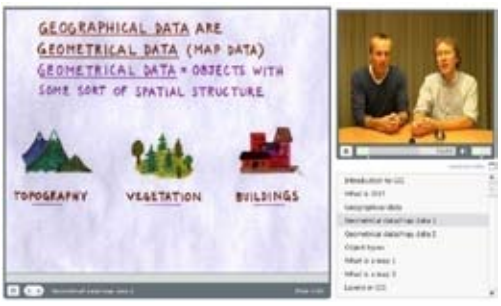
The purpose of using "clouds" is to let users find their own area of interest, and to navigate and "jump" depending on interest, need and curiosity. For example, under the "What is GIS?" cloud, short descriptive videos at different levels depending on the users pre-understanding will be found (Figure 1). In "Do it yourself" there are possibilities and information on what kind of software and web applications can be used, as well as examples on how to make a Google map and different kinds of exercises.

Figure 1: Overview of the eGIS+ portal(www.e-gis.org)



Results

The clouds in the portal are designed to be easily navigated depending on pre-understanding and level of complexity. When choosing a cloud, for example "What is GIS?" (Figure 2), there is an introduction with simple text and a voice explaining briefly what GIS is about. The explanation is captured from YouTube. As can be seen, there are options for more information if the interest increases (e.g. a video from Lund University that explains in more detail about GIS, Figure 3). This corresponds to the concepts of Laurillard (2002) [16], using different approaches such as production, interaction, discussion, adaptation and reflection, depending on different learning styles for individuals. Additional links in the cloud What is GIS? are to be found below.

Figure 2: The Cloud, Introduction What is GIS	Figure 3: Video from Lund University also in the cloud What is GIS?
	

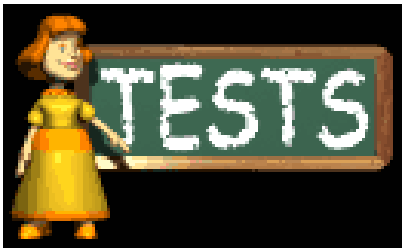
From the cloud, What is GIS?, there is information and further navigation with links for further learning possibilities depending interest, needs and level of complexity, such as:

GIS in two hours (http://www.e-gis.org/mod/data/view.php?d=4&rid=85)

Introduction to GIS in 18 min (http://www.e-gis.org/mod/data/view.php?d=4&rid=62)
Map Projections and Coordinate systems (http://www.e-gis.org/mod/data/view.php?d=4&rid=20)
Databases – introduction (http://www.e-gis.org/mod/data/view.php?d=4&rid=21)
Geo-spatial Information technology in China (http://www.e-gis.org/mod/data/view.php?d=4&rid=22)
Geodetic and cartographic Control Information System (http://www.e-gis.org/mod/data/view.php?d=4&rid=23)
"Google Earth viewing you" (http://www.e-gis.org/mod/data/view.php?d=4&rid=57)
(Google Earth introduced new and impressive possibilities in using geographical information. Some of the scenarios seem a little bit too far away, but exiting. Example of this is the video on YouTube)

Another cloud for navigation in the Portal is "Test Yourself" (Figure 4), a GIS test. Here, users will get an impression of how good they are "to do GIS". Different games that are already available on the Internet are provided here as re-usable learning objects [22, 23].

Figure 4, Test Yourself
Games where users will get a grading as in Travelling the World
http://www.e-gis.org/mod/data/view.php?d=5&rid=67



An additional example is from the Education cloud (Figure 5). Courses and education related to GIS are available here. In the eGIS+ Project four courses are developed: GIS Introduction 3 ECTS, Open Source Geospatial 3 ECTS, Introduction to SDI [21], 3 ECTS and GIS Introduction 10 ECTS. Partner institutions offering GIS courses are: Gjøvik University College, Lund University, Vilnius Gediminas Technical University and University of Patras. Meanwhile, Lund University has produced a set of Video Lectures available through the portal www.e-gis.org.

Figure 5. From the cloud GIS Education. Education related to GIS is found at many universities.

Among resources on the portal, different kinds of Web2.0 open resource applications [8-11] can be found mainly through Videos, e.g. YouTube etc. and computer-and paper based examples, The social computing and the benefits of those new pedagogical approaches are to a great extent the values in the eGIS+ project. Below follow some examples and as well in Table 2. In addition to open sources available on Internet, a great number of lecture materials have been produced.

Table 2: Overview of some courses material and how it can be structured

VIDEO Theoretical: (15-20 minutes)	Intro to GIS	Vector Structure	Vector Analysis	Raster Structure	Raster Analysis	GIS Databases	GIS Applications	Coordinate Systems	Optical Remote Sensing
VIDEO Applied: (15-20 minutes) *	GIS in Developing Countries	Internet and GIS	Introduction to Open Source GIS	Open Source Libraries	Usability for Maps GIS and Health	Geospatial Information Technology in China	GIS and Accessibility		
Seminars: (90 minutes each)	Different types of spatial modelling	How to meet crucial environmental threats using GIS							
Computer based GIS exercisesES (Open Source)	Basic Concepts of GIS								
Paper based GIS exercises	Modelling Soil Erosion	Spatial Analysis and Modelling of Forestry							

*6 shorter videos were produced where people from different academic backgrounds and geographical origins explain what they use GIS for and what GIS is for them.

Evaluation Process

The project has been disseminated and has been welcomed for its new concepts. The Portal is currently being positively evaluated in schools and is found to be useful as educational material. Children have enjoyed playing around on the portal, and have shown high levels of GIS understanding after tests. The eGIS+ project is also evaluated by the National Mapping Authorities of respectively Sweden (Lantmäteriet) and Norway (Statens Kartverk). These are also partners, and will among others be end users of the material for their staff.

Discussion

In society, in schools and in working places there are increasing demands for learning just in time and place. For informal learning to flourish it is crucial to find ways to develop and support this kind of learning in such a way that the ingredients that make it successful are kept in place, while avoiding the drawbacks that coincide with informality. The eGIS+ project and its ideas give meaning for the new learning paradigm with concepts such as tasters, re-useable learning objects, Microtraining and OER and even meeting the new millennium learners, e.g. school children, who use e-skills as a natural way of learning. The eGIS+ portal also offers and meets demands for different learning styles corresponding to Laurillards concepts [16]. Also the visions of Bologna beyond 2010 raise new demands for universities, not at least concerning Lifelong Learning and education for all. The eGIS+ project raises new opportunities

and challenges for universities and their contributions to informal learning in Lifelong Learning perspectives. The eGIS+ project can be considered a model in these respects.
eGIS+ is facing new challenges with the use of the same kind of content, but with different complexity. The ideas with tasters, Microtraining, OER, up to full Master are new concepts and challenges that need to be met by institutions aiming to become a Lifelong Learning Universities in accordance with the Bologna process and Bologna Beyond 2010 [24,25].

Conclusion

Information about the project has been disseminated in various European contexts and welcomed for its new concepts consisting of a broader range of target groups together with the use of GIS material with the same content but at different levels of pre-understanding, demands and complexity.

The material for school children is at present being tested in the partner countries. The portal and the material have been, so far, well accepted and welcomed by pupils and schoolteachers. They have found it interesting and like to play around with the games and other materials on different subjects. The portal design and navigation structure, with its clouds, has been well recieved due to its attractiveness and exciting approach. Users have confirmed that they apply many applications but that they did not know that GIS was behind them. Now they wish to learn more and to go further into details. This cannot be better expressed and is exactly what eGIS+ is about – to create awareness, curiosity and knowledge.

Bologna Beyond 2010 [24] emphasizes virtual mobility. Students need both formal and informal learning facilities. They need to be able to learn throughout their careers. Learning opportunities need to be flexible – either full or part time – at home or in the work place. Digital e-skills and competence are also highlighted [24,25] . eGIS+ as a project comes close to these new demands in the context of Geographical Information Systems (GIS) and its applications.

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