The Needs for Microtraining, Learning objects and Open Educational Resources in GIS

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The Needs for Microtraining, Learning objects and Open Educational Resources in GIS

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With today's rapid changes in socio-economy and technology, knowledge and learning are critical issues for private and civil service organizations. The needs for competence development range from short informal courses (without ECTS credits) to formal courses at university level (with ECTS credits). This article describes objectives and results of a Leonardo project, eGIS+ that developed and implemented course modules with a variety of complexity and duration in order to satisfy complex patterns of needs for competence development and training.

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), was to establish co-operation between European Universities and GIS user organisations and to develop modularised courses intended for Internet based learning. Another objective was to establish communication links within the partnership in the project and to disseminate and share "best practises" in different educational situations and for different target groups. The ideas were to spread 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 (K-12), students and researchers within higher education, employees in private- and civil service organisations and public in general. eGIS+ is based on results, experiences and further developments, from a previous Leonardo project E-GIS (2002 – 2006).

As the target groups are highly diverse, content, software, media presentations etc. was adapted to cultural and language differences within the partnership. All educational materials are available at www.e-gis.org, free of charge as open resources.

The aims within the project was to create awareness of GIS and cover GIS competence needs at a variety of levels in Europe through course modules that ties up with each other from very short informal modules with open content up to high level Master GIS programs.

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. Objectives of the eGIS+ project were to further develop results from a previous Leonardo Pilot Project E-GIS [1-5]. E-GIS was developed successfully during the period 2002 – 2006. Based on experiences from this project, the aims were to target a broader range of GIS user groups, such as teachers and pupils in schools (K-12), students and researchers within higher education, employees in private- and civil service organisations and public in general, in a lifelong learning perspective. Furthermore, to test out new Virtual Learning Environments (VLE) and different media software, translate course materials into partner languages, even to create modules in deaf language, and to create a large variety of duration of course modules; modules from just a few minutes to 10 ECTS (Table 1) and up to the Master Courses developed through E-GIS. The developed courses were; 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 [1-5]. Ten partners from eight countries in Europe participated in eGIS+. As the target groups are highly diverse, content, software, media presentations etc. was adapted to cultural and language differences within the partnership. All educational materials are available at the portal www.e-gis.org, free of charge as open resource. Responses showed already appreciation for creative and innovative approaches of the project with tasters, microtraining, re-usable learning objects and open educational resources (OER) from two minutes, two hours, two days, ECTS courses (3 and 10 ECTS), up to advanced Masters Courses already developed through a previous project E-GIS, in a real personalized dimension and within a lifelong learning perspective.

Demands 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 needs range from short informal courses to formal programs at university level. Informal learning is however 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 learners are responsible themselves The learner has to be active and take actions [6,7]. Learning is about personalized learning, participation, real-time mobility and portability. Some of the trends for the 21st century are mobile learning and ubiquitous learning (u-learning) [8]. 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 more anticipated that informal courses are offered by non-academic or private organizations.

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 life included in most fields of activities. Additional paradigm shift is about geo-everything, everything is almost based on and understood by space dimensions, geo-location, [9] and mobile computing, open content, augmented reality, gesture based computing and visual data analyses [10].

THEORETICAL PERSPECTIVES WITHIN EGIS+

Personalised Learning

In higher education there are new trends with critical challenges encouraging and provoking innovation in learning and teaching. Students have different background and learning styles and educational material has to meet different demands, levels and complexity. The learner has to be active her/himself, in taking actions. Learning is about personalized learning, real-time mobility, portability, mobile learning (m-learning) and ubiquitous learning (u-learning) which is the paradigm on learning for the 21st century [8, 11]. McLoghlin and Lee [12] stressed the three P´s of Pedagogy for a networked society, Personalisation, Participation and Productivity. Higher education is facing growing expectations for making use of and to deliver services, content and media to mobile devices and to use social computing to a higher extent. Obviously, there are increased demands for creativity, flexibility, new pedagogical approaches and personalized learning, such as Web 2.0+ [13-16] and Web Squared [17] among coming generations. Experience with, and affinity for games as learning tools is an increasingly universal characteristic among digital native learners, the new millennium learners entering higher education and the workforce [9, 10]. The emergence of digital native learners has major potential implications for education. The new generations' attitudes and expectations are important to recognize, appreciate and to understand. The impact of digital technologies, cognitive skills and learning expectations, and the evolution of social values and lifestyles are significant issues [8, 11, 12].

Enhanced learning and teaching through Web 2.0+

To enhance different learning styles, Laurillard argues for approaches as production, interaction, discussion, adaptation and reflection, to be considered and embedded in web course material [18]. Additional theoretical pedagogic concepts are eModerating and the five steps: access and motivation, online socialisation, information exchange, knowledge construction and development elaborated by Salmon [19]. Bonk [8] captures the personalized learning mode a bit further. He discusses venturesome and open-minded how technology not just can enhance learning, but also how web technology is revolutionizing education and are essential breakwater for learning in and for the 21st century. He introduce the concept of we-all-learn, which also is an acronym for; web-searching in the world of e-books, eLearning and blended learning, availability of open source and free software, leveraged resources and open courseware, learning object repositories and portals, learner participation in open information communities, electronic collaboration, alternate reality learning, real-time mobility and portability and finally networks of personalized learning. McLaughlin and Lee [12] discusses that the three P´s concept will lead to a diverse range of educational experiences that are socially contextualized, engaging and generative. In a mode with a mix of formal and informal eLearning jointly with microtraining, learning objects, OER and other open resources, those demands can be met.

Microtraining, open content and open educational resources (OER)

Traditionally, universities mainly offer formal courses with credits, while the real needs are far more for informal courses available on demand, flexible in time, path and pace,

and with a variety of complexity. Normally, it is anticipated that informal courses are offered by non-academic or private organizations.

In work integrated learning the concept microtraining [20-22] is common and research shows 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. In a lifelong learning perspective universities have to respond to these challenges. Microtraining has shown to be helpful in developing learning solutions that fit existing needs, and proven to be a suitable method because it emphasizes employees' to train themselves. In short sessions of 15 to 30 minutes with learning objects [23-24], basic knowledge is refreshed and expanded. Mictrotraining 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 through 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 [20-22].

Possibilities for distributing knowledge and creating flexibility to larger extent in different areas has been opened up through new technology [9,10] such as Web 2.0+ solutions [13-17], learning objects [23-24] and OER [25-31], and the use of microtraining [20-22]. Implementation and dissemination of the eGIS+ project is based on the web portal www.e-gis.org, designed with "navigation clouds", to be personalized, attractive, userfriendly and to give users a variety of possible entrances to participate and work with the material.

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 digital resources over the Internet in form of OER. An OECD study [25] on eLearning elaborates why this is happening, who is involved and about most important implications. The report offers a comprehensive overview of rapidly changing phenomenon of OER and challenges it poses for higher education. OER 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 eLearning or strategic decision making within higher education, to researchers and to students of new technologies.

Despite challenges of the 21st Century, many of today's schools and even universities still operate as they did at the beginning of the last century and are not encouraging deep learning and skills that generate innovative activity. How can educational institutions be transformed, to become environments for learning and teaching that turns individuals into lifelong learners and prepares them for learning and living in and for the 21st Century? [6, 10, 11]. The needs for OER [25-31] and microtraining [20-22] are also foreseen in society for training just in time and place, with demands for individual flexibility [9-11].

The eGIS+ portal and its content are build on above theoretical concerns. To understand the webportal and the content, some short overview of GIS follow below before the explanation of the project eGIS+.

ABOUT 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, spreading of diseases, physical planning etc.[32-35]. According to Chrisman [35] GIS is a system of hardware, software, data, people, organisations and institutional arrangements for collecting, storing, analyzing and disseminating information about areas of the Earth

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 (K-12), using games [36] on Internet or for different purposes in school work, 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 knowledge of GIS lies behind those functions. Demands for competence development within GIS in Europe are high, with heavy interest in short courses; particularly Internet based training with flexibility in time, space, level, content, pre-understanding and complexity [32-35].

The emerged concept Geo-everything which states that everything on Earth´s surface has a location that can be expressed with just two co-ordinates (geo-location) plays a new role in the GIS area and for 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. The quick evolution of Google maps and its applications are also prominent examples [9].

OBJECTIVES OF eGIS+

Needs for GIS knowledge in lifelong learning perspective vary with great diversity among target groups regarding previous knowledge, interest, profession, language, age and ability. Several questions can be raised; 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 other new target groups be captured? What about adapting courses for individuals with some kind of disability? These are challenges coupled with new competence demands for employees which are 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 short introductory “tasters” up to formal courses with credits, 3 and 10 ECTS [3-5].

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 • Open Source GIS • The implications of Spatial Data Information (SDI) [32] 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.

TABLE 1

DEVELOPED COURSE MODULES IN THE eGIS+ PROJECT [3-5].

THE WEB PORTAL AND ITS NAVIGATION STRUCTURE

In eGIS+, the Moodle based web-portal is designed and developed with a pilot in place, www.e-gis.org (Figure 1). The idea with the portal is to inspire and disseminate information about GIS and implemented courses and to be used for communication between partners, tutors and students during course implementation. The portal is designed by userfriendly “navigation 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 (Table 2). The modules will be translated to partner languages and deaf

language, with open access. The first level of course materials is modules which can be used for Microtraining [20-22] and as OER [25-31]. All materials and necessary GIS software is free of 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. open source, and thirdly covering the implications of Spatial Data Infrastructure (SDI) [37] 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 "navigation clouds" is to let users find their own area of interest, and to navigate and "jump" depending on personal or professional interests, needs 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 [3-5].

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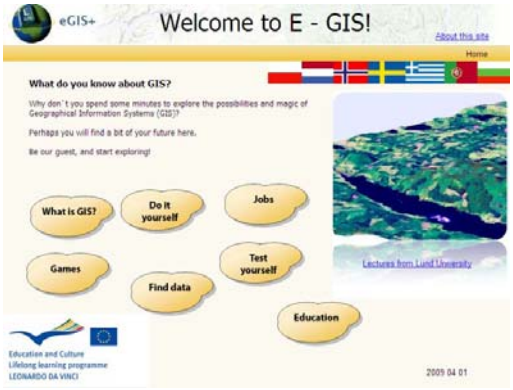

FIGURE 1
OVERVIEW OF THE eGIS+ PORTAL
www.e-gis.org

VIDEO Theoretical: (15-20 minutes)	Intro to GIS	Vector Structure	Vector Analysis	Raster Structure	Raster Analysis	GIS Databases	GIS Appli-cations	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	Geo-spatial Information Technology in China	GIS and Accessibilit y		
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	Using GIS for Spatial Analysis							
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.

TABLE 2
OVERVIEW OF SOME COURSE MATERIAL AND HOW IT CAN BE STRUCTURED [3-5]

RESULTS

As can be seen in the portal, there are options for simple explanations of GIS, e.g. from YouTube or, if the interest increases (e.g. videos from Lund University) that explains in more detail about GIS, (Figure 2, 3). This corresponds to personalization [8, 11, 18, 19] and Laurillard concepts [18], using different approaches depending on learning styles for individuals. Additional links in the cloud "What is GIS?" are to be found as below [3-5].

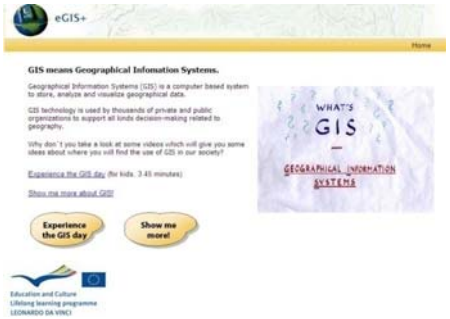

FIGURE 2
THE CLOUD, INTRODUCTION
WHAT IS GIS? [3-5].

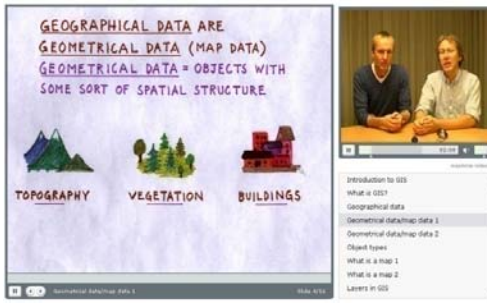

FIGURE 3
VIDEO FROM LUND UNIVERSITY ALSO IN
THE CLOUD WHAT IS GIS? [3-5].

From the same navigation cloud "What is GIS?" there are information and navigation with links for further learning possibilities depending interest, needs and level of complexity, such as: GIS in two hours, Introduction to GIS in 18 minutes, etc.
GIS in two hours; Introduction to GIS in 18 min; Map Projections and Coordinate Systems; Databases – introduction; Geo-spatial Information technology in China;
Geodetic and cartographic Control Information System; "Google Earth viewing you";
"Test Yourself" (Figure 4), Here, users will get an impression of how good they are "to do GIS" www.e-gis.org. Different games [36] that are already available on the Internet are provided here as re-usable learning objects [23, 24].

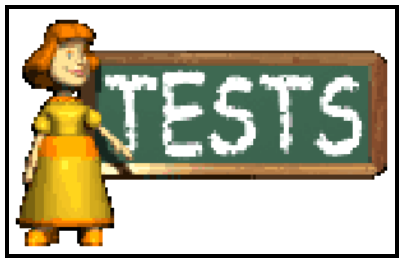

FIGURE 4
TEST YOURSELFGAMES WHERE USERS
WILL GET A GRADING AS IN
TRAVELLING THE WORLD [3-5].

In addition one example is from the Education cloud (Figure 5). Courses and education related to GIS are available here. In the eGIS+ Project four courses with credits were developed: GIS Introduction 3 ECTS, Open Source Geospatial 3 ECTS, Introduction to SDI 3 ECTS, and GIS Introduction 10 ECTS. All partner institutions offering GIS courses and a set of video lectures (Figure 6) has been produced within the partnership available through the portal www.e-gis.org.

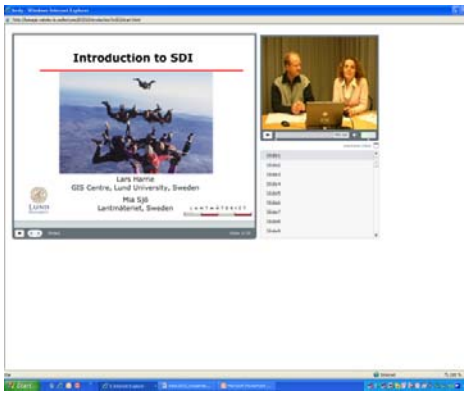

FIGURE 5.
FROM THE CLOUD GIS EDUCATION. THE SDI MODULE, 3ECTS [3-5].

Among resources in the portal, different kinds of Web2.0+ [13-17], open resource applications [25-31] can be found mainly through Videos, e.g. YouTube etc. and computer - and paper based examples, The social computing, the benefits of pedagogical approaches and more or less same content but on different levels, are to a great extent the values in the eGIS+ project. Below follow some examples and even in Table 2, above. In addition to open sources available on Internet, a great number of educational materials have been produced within eGIS+ by the partners, (Figure 6). The module What is GIS? is so far translated into partner languages and also interpreted into Swedish and Norwegian deaf language (Figure 7).

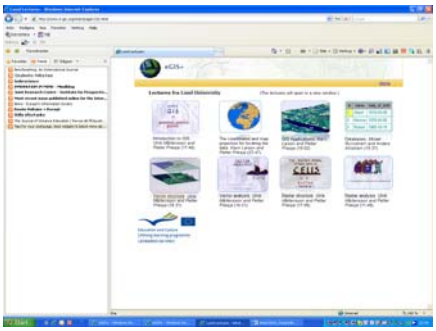

FIGURE 6
EDUCATIONAL MATERIAL PRODUCED BY PARTNERS [3-5].

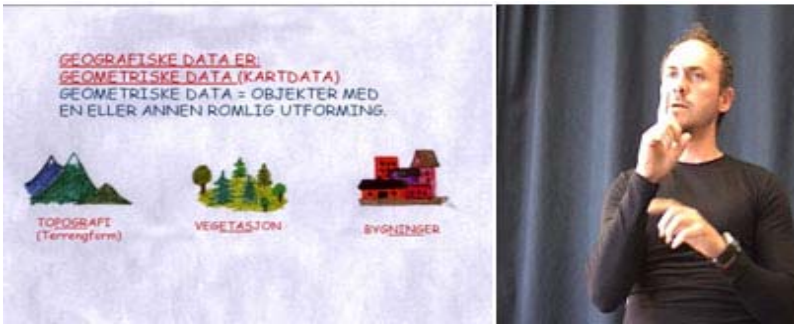

FIGURE 7
OUTLINE OF THE MODULE IN DEAF LANGUAGE (SO FAR IN NORWEGIAN AND SWEDISH). THE TEXT IN THIS FIGURE IS IN NORWEGIAN [3-5].

EVALUATION PROCESS

The project has been disseminated at international eLearning/web/ODL, GIS and engineering conferences to broad audiences. The project has so far been appreciated and welcomed for new concepts, ranging from microtraining to professional university courses, the pedagogical foundation, and the way to enhance learning through new technology and open sources. The portal was positively evaluated in schools and was found to be useful educational materials. Children have enjoyed playing around on the portal, and have shown high levels of GIS understanding after tests. The eGIS+ project is currently evaluated by the National Mapping Authorities in Sweden and Norway. They are also partners, and will, among others, be end users of the material for their employees. Supplementary the portal and the content have been continuously evaluated online from autumn 2009. The deaf language module has, in addition, been reviewed by the Norwegian Association for deaf language and the initiative was considered as innovative and userfriendly, so in this aspect the intention with an accessible portal even for disabled persons have been met.

DISCUSSION AND CONCLUSIONS

The eGIS+ project organized a network of European universities and GIS user organizations in order to share “best practice” for the development and implementation of different levels of GIS courses in order to target a wide range of different user groups. The idea was, in an innovative way, to give meaning for new learning trends in and for the 21st century within personalization, participation, flexibility [8, 11, 12], how new technology can enhance teaching and learning, with concepts such as tasters, open content, learning objects [23,24], microtraining [20-22], OER [25-31] and meeting the new millennium learners demands using e-skills as a natural way of learning. With the eGIS+ portal, the idea was to meet challenges for different complexity of content and different learning styles [18]. Also the visions of Bologna beyond 2010 and Bologna 2020 [38, 39] which raises demands for universities within lifelong learning perspectives were important issues in the project. So, how successful was the anticipated achievements? Did the partners obtain want they wanted when joining the project? Where

the project results satisfactory regarding the planned streamline along the aims; from GIS tasters, GIS games, and short informal courses up to formal courses giving 3 and 10 ECTS credits? Was the project able to access the anticipated broad range of user groups? All partners express their opinion about success for participating in the project. Looking upon the partner evaluation, some typical statements, expressing partner opinions, are given in the table below (Table 3).

Reasons for joining the partnership	Successful participation in E-GIS. Results used for updating teaching programs. Updating and learning through cooperation.	Getting more experiences with eLearning. Developing learning material.	Possibility of collaboration with European institutes, which have experiences in remote training. Building new partnerships within Europe. Strengthening existing partnerships within Europe.	Sharing competence and "best practice" within the partnership Professional development within GIS.
Benefits	Opportunities for exploring new software approaches and educational trends. Enriching programs for face-to-face teaching. Enable students' self-study by providing materials and evaluation.	New updated course material and eLearning experiences. Possibilities to learn modern Internet-based pedagogical methods.	Partnerships with EU partners. Established cooperation between partners – some European Universities and GIS organizations. Shared competences and "best practice" between partners.	Project helps members of the project to establish new personal contacts throughout the network and beyond.
Contribution	Production of contents.	Contribution to contents.	Translation of some of the material. Dissemination of project among a number of private and civil service organizations in.	Translation of text to partner languages. Development of presentations on GIS software and their relevance for t intended outputs of this project.
Future plans	Integration of modules in teaching programs, seminars and presentations.	Online content used in various educational settings. Increased collaboration with partners.	Possibilities to use created courses as a basis for developing new GIS courses.	To adopt the courses into ordinary educational national structures. Translate course modules into partner language.

TABLE 3
THE eGIS+ PARTNERSHIP, REASON FOR JOINING THE PROJECT, BENEFITS, CONTRIBUTION AND FUTURE PLANS.

The partnership succeeded in developing the planned products according to aims and objectives as explained earlier. Courses at all levels are being implemented around Europe at the moment, as planned

Materials for school children are 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 liked to play around with the games and other materials on different subjects. The final evaluation results from students were unfortunately not ready in time for this article. Information about the project has been disseminated in various European contexts and welcomed for the new creative and innovative concepts. Project ideas, processes and products, have been welcomed for the new creative and innovative concepts aiming to reach 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 portal design and navigation structure, with its clouds, has been well received due to its attractive userfriendly, personalized, innovative and exciting approach. Users have confirmed that they utilize 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. Expressions like these are exactly what eGIS+ is about – to create awareness, curiosity and knowledge.

Bologna Beyond 2010 [38] 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 – full or part time – at home or at working places. Digital e-skills and competences are highlighted [38, 39, 40]. In Bologna 2020 [39] two fundamental issues were raised; to educate more people, but not only more people, but also more people with different backgrounds in respect to age, culture and experiences in education and working life. The other aspect is about fast changing professional practice and globalisation and how to keep the staff in line with newly required competencies.

Harder, Minister of Education, DK pointed out that in a global perspective and in societies it is important to connect education and working life closer in the lifelong learning perspective [keynote speech ICEE/INEER Korea2009, 090824]. The eGIS+ project can be considered as a model in these respects [ibid. personal communication 090824].

The eGIS+ project comes close to new demands in the context of Geographical Information Systems (GIS) and its applications in a lifelong learning perspective.

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