

GIS in schools: State of the Art Report

iGuess Project

Final Version

22/5/2009

Contents

Contents	2
List of contributors	3
Summary	4
Introduction: GIS in a European context	5
GIS in Austrian schools	8
GIS in Belgian schools	11
GIS in Bulgarian schools	16
GIS in Finnish schools	17
GIS in French schools	20
GIS in Greek schools	24
GIS in Hungarian schools	26
GIS in English schools	29
Issues and Recommendations	33
Annex: The European standard for GIS in Secondary Schools	34

List of contributors

Aikaterina Klonari

Alfons Koller

Danielle Lavollée

Eric Sanchez

György Borián

Julie Godart

Karl Donert

Luc Zwartjes

Marc Deprez

Richard Pole

Sebastian Cathala

Stelian Dimitrov

Stanislas Pachulski

Sylvain Genevois

Tino Johansson

Summary

This report has been prepared by members of the iGuess Project team (www.iguess.eu). The purpose of this report is to set the European context for and then present the state of the art concerning GIS in secondary schools in different European countries.

The project team have identified the main issues involved in GIS in school education that need to be addressed when developing the teacher training course “*Introducing GIS use in Education in Several Subjects*”.

From the main issues, the project team make a number of recommendations concerning the nature and characteristics of GIS education, from which the course modules, and the exercises contained within the course, will be developed.

The European standard for GIS in school education, established by the HERODOT network in 2008 is provided in Annex.

Introduction: GIS in a European context

GIS and Geographical Information (GI) plays a key role in human activities today. Significant changes in the availability of and need for information by all citizens makes GIS very significant. Geographic Information Systems (GIS) are thus needed in European school education. It is one of the most relevant uses of computers and is a fundamental part of many educational subjects, with its roots firmly in Geography and geographical education.

GIS is based on a rapidly evolving technology, GIS provides a system of ordering, managing, manipulating and transforming large quantities of information, it offers the opportunity to combine, overlay or integrate data based on spatial location. GIS is also capable of providing visual representation of information. GIS is applied to solve 'real world' problems related to analysis, management and efficiency. GIS requires digital map information, locational data for the maps and software to process the maps and data. Increasingly, freely available on-line systems open the world of GIS to all.

GIS is a tool that is being used extensively in the workplace. It is used in business to inform decision making about real issues (Birkin *et al* 1998). It is thus a fundamental component enhancing employability. Innovative educators are now increasingly investigating productive uses of GIS in learning/teaching environments.

European developments

Developing a cohesive Geographic Information Strategy in education at European level is a high priority if future visions for European school education are to be achieved (Donert, 2007). The European Union has sought to establish policy frameworks and infrastructures to promote wider use of geographic information for decision-making, business, research, and society at large (Craiglia, 2004), but not yet for schools. The main challenges were identified as organisational, institutional, and political in nature.

The development of a European Information Society in Europe has been promoted since 1999 by the eEurope initiative (Commission of the European Communities, 1999). The key objectives have been to bring all citizens, business, and administrations on-line, promote education, and the availability of venture capital, and ensure that the whole process is socially inclusive and strengthening social cohesion. eEurope has been followed by two Action Plans for 2002 (Commission of the European Communities, 2000) and 2005 (Commission of the European Communities, 2002) focusing on cheaper internet access, education and skills, and key application areas including e-commerce, health, and the delivery of government services and information.

GIS has not specifically been referenced in either the eEurope policy or Action Plans, though Geoinformation in Education has been a priority in the IST (Information Society Technology) programme.

GIS in school education

There are many subject areas which benefit from learning with GIS. They lead to several different types of careers and professional activities involving GIS. This diversity leads to a broad range of educational needs for GIS in secondary schools.

From a European context, school education and qualifications have not been the subject of common European policy. There are few professional development opportunities for teachers in school education to learn about GIS and teaching strategies. Such activities are normally organised at national scale. Professional teacher associations like the Geographical Association in the UK (<http://www.geography.org.uk>) have attempted to provide CPD programme based on national needs. At a European level EUROGEO (<http://www.eurogeography.eu>) has offered teachers and teacher associations the opportunity to update their knowledge skills and expertise.

Professional development in GIS remains a difficult issue for many teachers working in European education. Language issues, curriculum opportunities and the expense of training continue to dominate the reasons why teachers do not do the training available to them.

Accepted European standards are needed concerning what GIS should be provided for secondary education. In 2008, the HERODOT Thematic Network for Geography in higher education started this process by producing benchmark statements for schools and teacher training (Donert, in press). These have since been open for widespread discussion and debate among experts. As a result they have been revised and accepted by leading experts in the field. They are presented in Annex.

Conclusions

From the outset it should be recognised that initiatives in GIS for secondary school education and related research has been extremely fragmented in Europe. There are also a number of problems which demonstrate the broad variety of institutional characteristics and cultures. GIS is applicable to a wide variety of curriculum themes and topics, from the social and economic sciences to the natural and environmental sciences. Hence GIS applications can range from crime to landscape management and from retail analysis to environmental modelling. The common feature throughout these applications, however, is the extent to which this technology opens up new possibilities for

students. It helps them in exploring their world and in handling and displaying spatial information.

The importance of professional development for teachers and the widespread use and implementation European standards is specifically highlighted.

References

- Birkin M, Clarke G and Clarke M (1998) GIS for business and service planning. In Longley P, Goodchild M, Maguire D and Rhind D (eds.) Geographical Information Systems: Principles, Techniques, Management and Applications, Cambridge, GeoInformation International
- Commission of the European Communities (1999). eEurope: an Information Society for All. COM(1999)687. Brussels: Commission of the European Communities,
http://europa.eu.int/information_society/eeurope/news_library/documents/index_en.htm
- Commission of the European Communities (2000), Proposal for a Directive of the European Parliament and of the Council on public access to environmental information, Brussels: European Commission. June 29, Report COM(2000) 402 final 2000/0169 (COD),p. 29, http://europa.eu.int/eur-lex/en/com/pdf/2000/en_500PC0402.pdf
- Commission of the European Communities (2002). eEurope 2005: An information society for all: An Action Plan, Brussels: European Commission, http://europa.eu.int/information_society/eeurope/news_library/documents/eeurope2005/eeurope2005_en.pdf
- Craglia M (2004), GI in the Wider Europe, GINIE Geographic Information Network in Europe, <http://www.ec-gis.org/ginie/>
- Donert K (2007), Geoinformation in Education: European Perspectives, 3-23; in Strobl J, Lernen mit Geoinformation II, Heidelberg, Germany, Wichman Verlag
- Donert K (in press), Benchmarking GIS: a charter for European Education, in press; in Jekel T, Koller A and Donert K (eds.) (2009), Learning with GeoInformation IV, Berlin, Wichman Verlag

GIS in Austrian schools

a) GIS and Educational Policy

The Austrian ministry of Education and Culture has edited curricula which contain GIS and geoinformation in an indirect way. They are not directly stated, but they are mentioned in a – let's say - open phrasing. Teachers are urged to use new media and modern technology as much as it is possible in their local learning surroundings in school. E. g. in the fifth class (at the age of 10) the curriculum contains:

„Ein Blick auf die Erde: Erwerben grundlegender Informationen über die Erde mit Globus, Karten, Atlas und Bildern“

which means in English:

“A view on the earth: Acquiring basic information on the earth by using globes, maps, atlases and images.”

This includes the use of online mapping, virtual globes, still and movie images on the Web as well. Thus it is not necessary to rewrite Austrian curricula. Teachers have to handle them including the use of digital media like GI-services and GIS-software.

In contrast to the situation in Germany, where GIS-skills are mentioned in several curricula, Austria concentrates on competences in Geo-Media and Geo-Citizenship at different stages of the school system. Pupils shall recognize spatial data as geoinformation during their daily life, ask and answer spatial questions, use Web-GIS-services and Geo-browsers, digital maps and virtual globes during their work in geography lessons. They shall become citizens who are aware of their personal use of geoinformation and participate in the public discussion on spatial issues.

Training for special GIS-software skills is not an aim of general education in Austria, but they may be used in secondary schools during courses of special interest (“Wahlpflichtgegenstand”) and in secondary vocational schools (“BHS – Berufsbildende höhere Schule”)

b) GIS – what is available in and for schools?

Looking at different stages of Austrian schools, we can say that in primary school (during four years from the age of 6 to 10) computers are mostly used inside the classroom. They are stand-alone PCs, quite old but enough equipped to use learning software on CD-Roms and DVDs and some office software as well.

In secondary education (“Hauptschule” – during four years from age 10 to 14; and “Gymnasium / AHS” – during eight years from age 10 to 18 and vocational schools / “BHS” – during five years from age 14 to 19) all schools have at least two computer-labs with 14 to 30 computers each. They have access to the Web and to the local computer network.

Besides them, there are several computer classes all over Austria, called notebook-classes, elsa-classes (elsa – elearning in everyday school) and ELC-classes (ELC - “E-Learning-Cluster”). All of these pupils use ICT during most of their lessons, geography lessons as well. They work pupil-centered and result-oriented.

Focussing software, Austria is in the fortunate situation that four Web-GIS services covering all the country are available. They provide, aerial photos, topographic and thematic maps and allow the analysis of data on all 2.500 public communities. For example, Austrian map www.austrianmap.at, Geoland www.geoland.at, Galpis www.galpis.at and the atlas of the Austrian conference of spatial planning OEROK www.oerok-atlas.at.

c) School(s) - what is happening concerning GIS?

Between 10 and 15% of all secondary schools are using ICT during their lessons beyond special ICT-lessons. In primary school the percentage is less. You find the reasons why it is not a higher amount in chapter G.

There is a special online-service: The educational Web-server Education Highway provides a special gateway to geography: gw.eduhi.at (Geography on the Web at Education Highway in Austria). On it there are lessons, worksheets, data for learning with geoinformation.

d) What resources are available to support GIS in schools?

While publishers like Westermann or Klett are preparing a wide spread of GIS-materials for schools in Germany, in Austria you can find only a very few amount of them. The country is too small and the competition is too strong, to develop a relevant market.

In addition to this, the academic sector has developed further initiatives: Besides gw.eduhi.at (mentioned above), the GIS-Day (www.gisday.at), the conference *Learning with Geoinformation* as part of the AGIT-conference/GI_Forum (www.agit.at, www.gi-forum.org) and as an annual publication at Wichmann were established.

e) Uses of GIS in the classroom

Some case studies, lesson plans and worksheets are published in “GW-Unterricht”, a quarterly paper-based journal, which will go online in September 2009 (www.gw-unterricht.at).

f) Training available for schools and teachers

Teacher training is held episodically in different regions of Austria, perhaps ten courses a year lasting from one to three days each. The participation is mostly free-of-charge. One course called “Wolfgang Sitte Seminar of geoinformatics” is held annually at the university of Salzburg; it is focussed on new development in GI and *Thinking spatially*.

g) What are the needs of teachers?

Geography teachers or teachers of geography and economy, which is a integrated subject in Austria, need more access to computer rooms and computers during their usual lessons. Since ICT has a major topic of interest, lessons of informatics fill up all computer labs, general subjects like geography do not find enough possibilities to use them any more.

Furthermore, a computer and a beamer are installed in only a few classrooms, so they cannot support geography lessons. Even the Web-access is not fast enough in most schools. So we have to wait a few years, when pupils come to geography lesson with their own smartphone or netbook.

h) Organisations promoting and using GIS and education

As mentioned above, the main centre of Learning with Geoinformation is the University of Salzburg, where a regional centre for didactics in geography and geoinformatics and a part of the Austrian academy of Science concentrating on GI Science has been established. In addition many teacher training courses are led from the Pedagogic University in Linz.

i) Any other information

GIS Day (www.gisday.at) has been developed considerably across Austria. Many companies are encouraged to present the use of GI technologies to pupils. For full details and requests please contact Alfons Koller in Linz (kol@ph-linz.at).

GIS in Belgian schools

In what concerns education, Belgium is split into 3 communities (based on their languages). The Flemish and the French communities are the most significant ones and are separately described in this report.

a) GIS and Educational Policy

In the Flemish education the only direct link to GIS is in one of the competences for pupils 3e grade (aged 17-18) in secondary education:

1 Kennis (Knowledge)
De leerlingen kunnen (Pupils can)
met een toepassing van GIS de betekenis ervan voor de samenleving illustreren. (illustrate with an application of GIS its significance for society)

This is the only place that GIS is mentioned.

In the French community GIS is not mentioned directly in any education program, but the following comes very close (same grade as Flanders):

COMPÉTENCES TRANSVERSALES (cross curriculum competences)
* traiter et analyser (lire, décrire, interpréter) des informations (cartes topographiques et thématiques, graphiques, tableaux) ;
(process and analyze (read, describe and interpret) information (topographic and thematic maps, graphs, tables))
* présenter les résultats de la recherche sur différents supports (cartes, graphiques,...)
(present the results of research on different media (maps, graphs, ...))

b) GIS – what is available in and for schools?

In the Flemish community:

Computer/software:

- almost all schools have broadband internet access
- as a consequence of funding during some years (PC –KD project) in secondary schools on average there's 1 computer / 5 pupils
schools can sign in for an agreement between the government, VVKSO (in Flanders) and Microsoft for legal software (Windows, Office, Frontpage, Encarta)
- for GIS schools can take the offer of ESRI: K-12 package: ArcGIS with 5 hardware keys for 500 computers: 1000 EUR, or we can take the

offer of OrbitGIS: free software package

In both cases software is in English.

- A lot of governmental services have a GIS web application to consult GIS-data, f.i. GeoVlaanderen (via www.agiv.be) or Giswest.
- AGIV also has an application (Giraf), where data can be purchased – for education at discounted prices or even free, the data can be downloaded or ordered on dvd.

French community:

- I. Le projet **Cyberclasse**. Project initiated in 1999 to provide computer pools in schools in the Walloon Region. Mac for primary school (6-12) PC or Mac for secondary school (12-18).

<http://cyberclasse.wallonie.be/pages/cyberclasse-en-detail/index.html>

- II. **Internet à l'école - project I-line** started in 1998, to equip every school with an internet access

http://www.internet-ecoles.be/ilines_biblios.html

Brussels Region (both communities)

- III. Le Plan **Multimédia**: project started in 1998 to equip schools in the Brussels Region with computer pools and internet access coordinate by the CIRB (Brussels public administration). Following the CIRB 95% of schools are equipped.

CIRB website:

http://www.cirb.irisnet.be/site/fr/qui_vous_etes/ecoles/index_htm (Fr and NI)

- IV. **Urbizone** - part of Plan Multimédia: project started in 2006, set-up a wifi network for college (école supérieure >18). So far 7 colleges or universities in Brussels are equipped.

http://www.cirb.irisnet.be/site/fr/qui_vous_etes/ecoles/superieur (Fr and NI)

c) School(s) - what is happening concerning GIS?

As GIS is only mentioned in Flanders there is some use of GIS, although it mostly exists with free on line applications. The real GIS work is mostly consequence of a very enthusiastic teacher who uses GIS in many ways.

There has not been any real research about GIS in Flanders. The only research has been done for the French community is: "Les SIG. Préliminaires à un usage dans l'enseignement" (abstract in English)

<http://www.geoeco.ulg.ac.be/societe/publi45.htm>

Some good examples of GIS-projects:

- GISAS, European project with a.o. KOGEKA:
<http://www.edu.fi/english/page.asp?path=500,5372,30670,53561>

- Leiedal: GIS package about environmental planning, made with cooperation of some teachers
<http://www.leiedal.be/rogis/>

GIS software in school:

- Since the end of the 1990's, ESRI has provided schools with free licenses for ArcView
- Recently, ESA provides schools with LEOWorks for free, this is image analysis software. School can also buy the ESA Atlas (30€), teachers can ask for training and manuals (110€ in total)
<http://www.eduspace.esa.int/eduspace/main.asp>

Some schools are also using free GIS available on internet ex (from most used to lower used):

1. FGIS http://www.pedagogie.ac-nantes.fr/1171391154640/0/fiche_resourcepedagogique/&RH=1160730677453
2. DIVA GIS <http://www.diva-gis.org/Data.htm>
3. Quantum GIS <http://www.qgis.org/>

d) What resources are available to support GIS in schools?

School textbooks:

- In Flanders for the 3th grade GIS – including data set + free software – is on a CD-rROM with the textbook Geogenie 5&6 Geogenie aso-wetenschappen 5 & 6
- Robert Neyt, Georges Tibau, Anke Van Berendonckx, Chris Van Broeck, Ria Van Mol, Els Paternoster, Carina Vanhamel, Luc Zwartjes 2006 Uitgeverij De Boeck, Antwerpen
<http://vrij.uitgeverijdeboeck.be/collections/geogenie5/>

Other resources to support GIS are from the government free GIS web applications to do some simple queries on GIS.

The 2 major sites are:

- in Flanders: Geo-Vlaanderen: <http://www.agiv.be/gis/diensten/geo-vlaanderen/?catid=8>
- in the Walloons: Portail Cartographique de la Région wallonne
<http://cartographie.wallonie.be/NewPortailCarto/>

e) Uses of GIS in the classroom

GIS is used mostly on 3 areas:

- study of the dynamic planet (plate tectonics ...)
- study of environmental planning
- as part of an excursion (mapping the results).

Example of school:

At the secondary school Sacré-Coeur de Charleroi (Walloon region), a group of teachers had a Comenius project to provide GIS training to teachers. The project has now ended.

f) Training available for schools and teachers

In Flanders there are two major in service training centres:

- the VVKSO has organised since 1986 in service ICT teacher training, including since 2000 ICT for Geography (and thus including GIS courses)
<http://www.nascholing.be>
- the government has its own system of in service trainings, including sometimes small GIS courses:
<http://www.renvlaanderen.be/static/home.php>

Courses are paid for by the school who receive money from the government for in service training of the teachers.

Besides these 'official' channels there are also small courses organised by the regional sections of the VLA, which are very cheap.

In the Walloons area there is no governmental organised in service training. The only GIS training is done during symposia and other meetings of teachers, for example, meetings of FéGéPro, the Walloon organisation of Geography teachers.

g) What are the needs of teachers?

Teachers really want worked out good lessons where GIS is used as a tool to do the research. Most material they find is in English and therefore not useful because (certainly for environmental planning) it does not relate to their own region.

h) Organisations promoting and using GIS and education

AGIV: <http://www.agiv.be/gis/>

- offers on line GIS web application
- possibility to buy data sets via Giraf (<http://giraf.agiv.be/>)

ESRI: <http://www.esribelux.be/>

- every year in the GISweek they organize a GIS day for education
- organises a (rather expensive but) very well elaborated course scheme for GIS, together with the KU Leuven

Eurotronics: <http://www.eurotronics.com>

- offers the full GIS package OrbitGIS (<http://www.orbitgis.com>) for free to all teachers, pupils and students in Belgium

i) Any other information

Unlike the Netherlands, GIS Day is not well organised in Belgium. Only ESRI is making efforts to promote this.

Courses:

http://www.educreuse23.ac-limoges.fr/loewy/realisations/Sig_Limoges/sommaire.htm

<http://eoedu.belspo.be/fr/profs/index.htm>

GIS in Bulgarian schools

The use of GIS in schools in the country is limited compared to the majority of EU member states. The use is limited to the use of digital globes and online mapping in different subjects –primarily informatics and geography. The only real use of a desktop GIS is at the National Natural-Mathematical Secondary school, which can be considered a lyceum of the Sofia University “St. Kliment Ohridski”.

Related matters such as CAD, GPS, etc. are taught within specialized schools of construction, architecture and geodesy.

There is however serious potential for the introduction of GIS - all schools in the country now have computer laboratories, and the majority are equipped with broadband internet which can stimulate the exchange of data and materials concerning the education through GIS.

Potentially, considering the structure of the curriculum in Bulgarian schools, the major ‘users’ of GIS-based teaching techniques would be the teachers in geography, history, biology and informatics.

GIS in Finnish schools

a) GIS and Educational Policy

GIS is mentioned in the National Frame Curriculum for the Upper Secondary Schools (2003). GIS is not the main focus of the curriculum, but part of the the key contents of a geography course (GE4), which is an elective and the fourth geography course taken at the upper secondary school level in Finland. The pupils in that course are usually completing their last year in school and are between 17 and 18 years of age.

b) GIS – what is available in and for schools?

Most secondary and upper secondary schools have at least one computer lab with workstations, Internet access and Microsoft Office software. Only a few Finnish schools have desktop GIS software available in the school computers. Most schools use Web mapping services. The schools in Espoo (the second largest town in Finland) received rights in 2009 to use a server-based GIS software (MapInfo Professional 9.0) provided by the municipality and simultaneously have an access to some GIS databases of their own region. The software is available in Finnish. In Helsinki, the Viikki teacher Training School of the University of Helsinki has ESRI's ArcView software in use but it is an English language version. Usually, one of the problems for the schools in Finland has been the availability of GIS data. Paikkatietolainaaamo (Spatial Data lending facility) has provided some GIS data free to the schools, but there data has been available only on the areas which cover south-western parts of the country. Kansalaisen karttapaikka has also been used by the schools to get maps and data for lessons.

c) School(s) - what is happening concerning GIS?

Despite the support of the national curriculum, GIS is not very widely taught in Finnish schools, except during the elective GE4 geography course. There is a wide variation between the schools according to the use of GIS in education and the GIS experience of their teachers, so those teachers who have received GIS training during their university education prefer to utilise the tool in their work. Tino Johansson has carried out a questionnaire survey on the Finnish situation together with Ms. Minori Yuda in autumn 2006.

d) What resources are available to support GIS in schools?

Three publishing companies have published GIS workbooks in Finnish for the upper secondary schools in Finnish. These companies are Otava, Tammi and WSOY.

- Löytönen, M., Kankaanrinta, I-K. and Toivonen, T. (2003): Globus GIS. http://www.booky.fi/book.php?book_id=9789510260890
- Antikainen, J., Kankkunen, J. and Karas, K. (2007). GE4- Aluetutkimus. <http://www.adlibris.com/fi/product.aspx?isbn=9512653524>
- Fabritius, H., Kenno, P., Nowak, A. and Ruth, C. (2009). Lukion maantiede 4. Aluetutkimus. <http://www.bookplus.fi/product.php?&isbn=9789511197249>

e) Uses of GIS in the classroom

GIS is mostly used for the visualisation of spatial images or elements by making maps and locating topical places, but it is seldom used for any spatial analysis. However, there are a few schools where the teachers with GIS experience use it for querying, collecting databases based on locally collected data and use it to answer geographical questions.

f) Training available for schools and teachers

The National Board of Education in Finland, different universities, geography teachers' association and individual teachers have provided in-service teacher training for Finnish geography teachers on GIS. With a few exceptions training is free for teachers. The Lifelong Learning Center (Palmenia) at the University of Helsinki has organized in-service training courses on GIS in collaboration with the Department of Geography. In March, Dr. Tino Johansson organized a two-day training course on GIS which was funded by the Espoo town. The target group was geography teachers from different upper secondary schools in Espoo who start using MapInfo there. The Continuing Training Centre at the University of Oulu will organize an on-line in-service training course on GIS for teachers in spring 2009. The Häme Polytechnic also provides a training course for the teachers on GIS in Finland.

g) What are the needs of teachers?

Teachers need in-service training, better access to databases and good ready-to-use pedagogical examples of how to use GIS in schools. Tino Johansson has published some papers on this in a Finnish geographical journal *Terra*.

h) Organisations promoting and using GIS and education

ProGIS association, ESRI-Finland Inc., Affecto Genimap, University of Helsinki and University of Turku, CSC (IT Center for Science), National Land Survey of Finland. The private companies offer discounts on GIS software and databases for schools and the semi-public organisations deliver some databases for the schools to be used in education. The universities develop

portals together with the companies to ease schools and public access to geoinformation in Finland. Currently, a national programme on a web-portal called PaikkaOppi takes place in the country. The product will be an open access learning environment on GIS. <http://www.vesseli.fi/paikkaoppi/>. The CSC opened a Paituli data delivery service for the university teachers and students in April 2009. It is a free portal with access to numerous national; databases which are produced by different national agencies in Finland.

i) Any other information

A few schools have taken part in the GIS day activities and there is no precise information on their work and activities. Dr. Johansson has once organised a geocaching afternoon for one Finnish secondary school during GIS day.

GIS in French schools

a) GIS and Educational Policy

- **GIS is not directly part of the curriculum**, but it is mentioned in the tutorials for Geography-History teachers (Accompagnements de programmes)
- 1990 the Ministry of Education (Sous-Direction TICE) created an experimental GIS group on national level (it was in connection with the treatment of satellite images and the TITUS experience) but it does not exist anymore.
- **GIS is not a priority for the French Pedagogical Inspection Service** but the seminar held in 2008 for the biology and geology inspectorates had included the topic in the program
- There is **no GIS frame of reference of competences, in any subject**.

b) GIS – what is available in and for schools?

- Internet access and the number of computers globally is increasing (cf. Study of the Ministry of Education), but the real pedagogical uses is not so high, because these official statistics refer to the number of computers for students
 - They are big differences between the schools
 - **They are many technical, material and pedagogical obstacles for the use of GIS in the classroom** (cf. Study of INRP 2007 on the website of the Observatoire des Etudes géomatiques)
 - Software : ESRI software is available in French and the materials from the GISAS project as well
 - Data: Some data of the IAURIF (Institut d'Aménagement et d'Urbanisme de la Région Ile-de-France, <http://www.iaurif.org/>) is free for education
 - The Ministry of Education in collaboration with the IGN (National Geographic Institut) have produced a **website called EDUGEO** based on the French Geoportail to share data and experiences, but it not free. It is for teachers and students for primary and secondary schools
- Edugeo:** <http://www.edugeo.fr/>

c) School(s) - what is happening concerning GIS?

- Generally schools are not working with GIS in France.
- **The Institut National de Recherche Pédagogique (INRP)** plays a leading role in research about the educational use of Geomatics and GIS.
- 2005 the «**Observatoire des pratiques géomatiques**» was created by Sylvain Genevois (sylvain.genevois@inrp.fr) and Eric Sanchez (eric.sanchez@inrp.fr). This observatory carried out an enquiry about the uses of geomatics by teachers in secondary schools. 862 teachers

answered the web questionnaire. The objectives and the results are described on the website:

<http://eductice.inrp.fr/EducTice/projets/geomatique/observatoire>

-See also the doctoral works of the 2 authors available on the open archives:

- S. GENEVOIS (2008), Quand la géomatique rentre en classe. Usages cartographiques et nouvelle éducation géographique dans l'enseignement secondaire. Thèse de doctorat, Université de Saint-Etienne, UMR 5600, <http://tel.archives-ouvertes.fr/tel-00349413/fr/>
- E. SANCHEZ (2007), Investigation scientifique et modélisation pour l'enseignement des sciences de la Terre. Contribution à l'étude de la place des technologies numériques dans la conduite d'une classe de terrain au lycée, Université Claude Bernard - Lyon I, <http://tel.archives-ouvertes.fr/tel-00199077/fr/>

d) What resources are available to support GIS in schools?

- GIS is not introduced in school text books in France.
- **The Ministry of Education** has thought for many years about the possibilities to develop GIS for education and undertook in 2006 a study "Mission d'analyse, d'étude et de conseil stratégique sur le développement et la mise en oeuvre de logiciels SIG dans un contexte éducatif" (cf. study of IETI Consultants). Unfortunately the results are not published and no GIS tool is produced now for teachers and students in secondary schools.
- **The company ESRI France** (Responsible for Education: M. Pachulski) has tried to propose tools for education in secondary schools (ArcExplorer).
http://www.esrifrance.fr/metier_educ_rech.asp
ESRI-France helps the ISC-School in La Ville du Bois, which is involved in the European IGUESS project and offers a technical help to train teachers and free licences for the students.
- **Annual SIG conferences of ESRI-France:** SIG 2009: French ESRI user conference with some Educational workshops (September 30 - October 1 2009)
- **Annual conference FIG :** Festival International de la Géographie of St Dié des Vosges (beginning of October)
- **Eduterre:** <http://www.acces.inrp.fr/eduterre-usages/ressources/accueil/presentation>

e) Uses of GIS in the classroom

- Under 10% of teachers have used GIS with students (but around 80% have used a virtual globe), but the virtual globes such as **Google earth** and the **French geoportail** are very successful. See the results of the study from the INRP (2007) about the uses of geomatic tools in teaching History-Geography and Biology and Earth Science:
<http://eductice.inrp.fr/EducTice/projets/geomatique/enquete2007>

- **Geoportail:** www.geoportail.fr
- **Experiments at “Académie” level:**
 - **Académie of Dijon** (History-Geography)
<http://histoire-geographie.ac-dijon.fr/SIG/Carto/sig/sig6.htm>
<http://appli-etna.ac-nantes.fr:8080/peda/disc/svt/tice.htm#tele>
 - **Académie de Montpellier :**
<http://pedagogie.ac-montpellier.fr:8080/disciplines/svt/spip/spip.php?mot72>
 - **Académie de Nantes** (Biology and Earth science):
http://www.pedagogie.ac-nantes.fr/25934359/0/fiche_article/&RH=1177423021656
or http://acces.inrp.fr/eduterre-usages/ressources_gge
- **Geowebexplorer** Portail (INRP - Université de Saint-Etienne)
<http://hal.archives-ouvertes.fr/docs/00/27/98/98/PDF/CQFD09.pdf>
- **WINGIS** : free software develop by a teacher in the Académie de Dijon
- **F-GIS** : translated in French and used in many académies
- **Q-GIS** : more used in agricultural teaching (Negociation for free use of geographical data with the IGN and thanks to the Ministère de l’Agriculture)
- Software **Sismolog**, editor Chrysis, used for many years by Biology and Earth Science teachers.
- **European project GISAS** (2003-2006) using Esri software: Arcview 8.3
- **Projetice:** www.projetice.fr

f) Training available for schools and teachers

- The INRP-Lyon has organised **one day courses for teachers, teacher trainers and inspectors** since 2006 about the use of Geomatics in France: **4eme Journée d'étude géomatique INRP** (next one: 13 May 2009).
- Collaborative Teacher Training face-to-face and at a distance about virtual globes with “**Pairform@nce**”: <http://edu-fc.pairformance.education.fr>
Pedagogical and didactical help : ready-made sequences and tutorials to work with new geomatic tools such as Google Earth, Virtual Earth, Worldwind, Géoportail...).

4 modules are proposed:

Module 1: visualising geological and geographical information.

Module 2: use and edit georeferenced data.

Module 3: investigate and solve a problem with case studies.

Module 4: lead a geoprotect

- GIS training is also proposed at professional centres as GRETA or universities:

http://www.esrifrance.fr/iso_album/livret_education_web.pdf

g) What are the needs of teachers?

- Many teachers are not used to work with ICT with their students. For them introducing GIS in their courses represents a big obstacle.

- Because teachers are not aware and have a lack of skills, they need **teacher training and easy access to the courses and the software. They need software, data and teaching materials adapted to their educational context.**

- GIS software and teacher training are expensive for secondary schools.

- It is important to see two different kinds and levels of needs by teachers

a) GIS tools and geographical or geological data: the access to geographical information is easier now (cf. directive INSPIRE). Because of the lack of GIS software for education, it is more difficult to train teachers to use different software.

b) Concerning teachers: there are two different groups of teachers

i) teachers who are able to work with GIS and to create their own pedagogical GIS exercises

ii) teachers who use the GIS software by discovering geomatics (most of the time with the virtual globes).

h) Organisations promoting and using GIS in education

- **INRP : Eductive - Observatoire des pratiques géomatiques :**

www.eductive.inrp.fr/

- **ESRI-France:** One person is dedicated to the Education Market to promote the use of GIS in school, helping teachers when it is possible, offering big discount on software, and lobbying to introduce GIS at school. The main project is to create a French book for teachers with lessons and data.

- **Academies and the Ministry of Education**

i) Any other information

None

GIS in Greek schools

a) GIS and Educational Policy

Unfortunately there is no reference either in our national curriculum or in educational policy papers about GIS exactly. There is a general reference about use of ICT in Primary and Secondary Education (Compulsory Schools and Post Compulsory Schools - mainly ages of pupils/students 12-18 years old, sometimes from 10 years old-)

b) GIS – what is available in and for schools?

All schools in Secondary Education (Lower and Upper Secondary Level) have access in Internet, there is educational software for several subjects, but there are not data concerning availability of GIS. Most of the software used in schools is in mother tongue

c) School(s) - what is happening concerning GIS?

There is some research about the state of GIS in secondary education and the results are that there is no experience either from students or teachers.

d) What resources are available to support GIS in schools?

For the first time there is a paragraph in one new geography textbook (A' Gymnasium - Lower Secondary School-students age 12-13 years old) that refers GIS and GPS in the Unit about "Maps"

e) Uses of GIS in the classroom

None

f) Training available for schools and teachers

There are e-learning courses about GIS in NTUA (National Technical University of Athens) and teachers must pay fees)

g) What are the needs of teachers?

The problem in my country is that there are few geographers in higher education who are teaching geography. This year is the first time that geographers have the opportunity to teach in secondary schools. So, of

course geographers think that is very important to teach GIS in Secondary Schools especially in Upper Secondary Level (General, Vocational and Technical Schools)

h) Organisations promoting and using GIS and education

Marathon Data promotes the use of GIS in Universities (Tertiary Education) organising meetings for the briefing of universities' teaching staff

i) Any other information

None

GIS in Hungarian schools

a) GIS and Educational Policy

There is no reference to GIS

b) GIS – what is available in and for schools?

The Internet is available in every Hungarian school (Schoolnet: www.sulinet.hu)

So, there is access to Google Earth and Map and other online maps. Google Earth 5.0 is in Hungarian

Some 'elite' vocational schools (specialised in surveying, forestry and agriculture) have ArcView software and Hungarian software DigiTerra created especially for agriculture

c) School(s) - what is happening concerning GIS?

Schools are not doing GIS.

There has been no research done in Hungary about GIS in schools? I

The following schools are specialized schools (not simple secondary schools):

- **Neumann János Számítástechnikai Szakközépiskola** (specialized in ICT): middle level certificate at GIS can be obtained, www.njszki.hu
- **Kós Károly Építőipari Szakközépiskola (Miskolc)**: Since 1968 surveying has been taught, and in the last few years GIS education started. <http://pc1.koosk-misk.sulinet.hu/~koos/>
- **Pollack Mihály Műszaki Szakközépiskola és Szakiskola (Pécs)**: Students can get a qualification in GIS and surveying GIS is taught in the subject surveying. This certificate allows the students to work as middle-level technicians. <http://www.pollack.hu/>
- **Bezerédi István Kereskedelmi és Közgazdasági Szakközépiskola (Szekszárd)**: GIS is taught in the framework of economics. <http://www.keri-szeksz.sulinet.hu/>
- **Vásárhelyi Pál Műszaki Szakközépiskola (Békéscsaba)**: Students can get a certificate in GIS and surveying. GIS is taught in the subject surveying. This qualification allows the students can work as middle-level technicians. <http://www.vpmsz.sulinet.hu/>
- **Zsigmond Vilmos és Széchenyi István Szakképző Iskola (Nagykanizsa)**: Students can get a certificate in GIS and surveying. GIS is taught in surveying. This allows the students to work as middle-level technicians, www.zsvszi.hu

- **Varga Márton Kertészeti és Földmérési Szki (gardening and surveying):** Students can get a certificate in GIS and surveying. GIS is taught in surveying. This degree allows students to work as middle-level technicians, www.vmszki.hu
- **Széchenyi Ferenc Gimnázium (Barcs):** This school participated in the GISAS project. They use GIS in geography lessons and European school projects. www.szechenyi-barcs.sulinet.hu/
- There are four Forestry Schools where GIS is used. They use mainly the Hungarian DigiTerra software
- **Neumann János Általános Iskola** (The only elementary school where GIS is used – it is specialised in ICT) <http://www.enjai.sulinet.hu>

d) What resources are available to support GIS in schools?

The schools specialised in surveying use the following academic books:
 Márkus Béla: Térinformatika 1. Elmélet, Térinformatika 2 Gyakorlat, Dr. Sárközi Ferenc: Térinformatika, (Térinformatika = GIS in Hungarian)
 Dr. Márkus Béla, Dean of GIS Department at West Hungarian University:
<http://w3.geo.info.hu/~ga/fttk2/?q=hu/taxonomy/term/5>

Arcview software is available in a short Hungarian version.

e) Uses of GIS in the classroom

Technical schools: mainly students learn how to use Arcview and DigiTerra software. In field practice: the technical schools mainly use GIS data recording, water and forest monitoring, surveying

Normal schools: in the classroom: the only example is creating routes on Google Earth in Geography and visiting some places

f) Training available for schools and teachers

a) ESRI organises training which is very expensive

b) Only postgraduate courses are available for teachers of technical subjects (engineer-teachers). Very expensive

c) GREEN Pannónia Foundation has been organising training for water quality assessment combined with GIS for 4 years. (more than 100 teachers have attended these courses) The GREEN Pannónia Foundation organises courses for teachers of secondary schools specialised in environmental protection

www.bisel.hu

www.biselmester.extra.hu

www.biogis2005.uw.hu

These courses are financed by different funds, Ministry of Environment and EU. The teachers have to pay a very small contribution.

g) What are the needs of teachers?

Most of the responses say that we need software and books in the Hungarian language.

There appears to have been no research in Hungary.

h) Organisations promoting and using GIS and education

ESRI Hungary: Sending newsletter, magazines, mails, etc. Promoting GIS day

GREEN Pannónia Foundation: organizing courses for teachers of secondary schools specialized in environmental protection

www.greenpannonia.hu www.bisel.hu

GITA MŰSZAKI TÉRINFORMATIKA EGYESÜLET (GIS Association), 1111 Budapest Műegyetem rakpart 3. Kmf 16. BME Általános és Felsőgeodézia Tanszék, (Technical University of Budapest)

DigiTerra Company www.digiterra.hu

i) Any other information

No further information

GIS in English schools

a) GIS and Educational Policy

There have been a number of developments during the last few years to encourage GIS in the curriculum.

EDUCATIONAL POLICY The QCA (Qualifications and Curriculum Authority) leads, develops and reviews the national curriculum for the government. Since 2007 the QCA has made the use of GIS mandatory in KS3, KS4 and A level and suggests and promotes its use in Primary schools. Recent curriculum changes to promote GIS in Geography include;

- KS3 National Curriculum 2007
- KS4 New Syllabuses from Sept 2009
- KS5 New Syllabuses from Sept 2008

National Curriculum statutory requirements state:

“Through studying geography pupils will ...learn to think spatially and use maps, visual images and new technologies, including GIS, to obtain, present and analyse information.”

More specifically: ‘Key Processes’ outline GIS as one of the “essential skills and processes that pupils need to learn.” And that GIS is integral to ‘Fieldwork tools’ and ‘Geographical Data’.

At KS4 (aged 14-16) and KS5 (16+) GIS is a requirement within the ‘geographical skills’ element of all syllabuses. All examination boards offer opportunities to develop GIS within core and optional topics, many make specific reference to areas of their syllabuses where GIS is encouraged/expected. GIS extends the possibilities for fieldwork & coursework.

GIS has a major role to play in geographical enquiry as it: “encourages questioning, investigation and critical thinking about the issues affecting the world and people’s lives, now and in the future.” *a quote from national curriculum statutory requirements ‘07*

b) GIS – what is available in and for schools?

ICT All schools have, as a minimum, at least 1 computer in every classroom.

At Primary school there is always either a PC lab of 20+ computers or a mobile laptop lab that can be moved from classroom to classroom.

At Secondary school the average number of computers per school is 226 (DFES statistic 2007) with some schools giving access to laptops to ALL students starting from year 7.

INTERNET All schools have access to Internet and are connected to a education super-intranet called JANET making school-to-school and school to grids-for-learning far quicker than normal internet use. However, using Google Earth and streaming online video during a class can still be prohibitively slow in some schools.

Software has seen a significant boost during the government sponsored and run, Curriculum Online programme which has injected over £500M into schools from 2003 – 2008 just for software. For the academic year 2003-04, for instance, schools in England received £100million to spend on multimedia resources (software NOT hardware). Every eligible school received £1000, plus almost another £10 per pupil. This money is allocated to individual schools by their LEA. It is available to all Government-funded nursery, primary and secondary schools in England, up to and including Key Stage 4, as well as Foundation and SEN.

From August 2008 a new programme called the Harnessing Technology Grant has begun which sees the money allocated to the Local Education Authority rather than directly to the Schools.

All GIS software is available in the mother tongue.

HARDWARE can prove to be a limiting factor in schools as computers get older. However, most schools have rolling 3 year replacement programmes. Over ½ the schools have contracts with a company called RM who provide PC's on loan and replace after 3 years.

DATA For the last 4 years the availability of data from government agencies such as the Environment Agency (EA), Office of National Statistics (ONS) and the Ordnance Survey has not been a major issue. However, it still requires the teacher to know and understand what they are asking for, what they can do with it and in what format it comes in. The EA and ONS have data available for download and the OS has provided their data through the Map Pilot.

c) School(s) - what is happening concerning GIS?

Only a handful of schools are using GIS with the most active schools in being at Secondary level. Schools that are undertaking GIS are choosing typical Geography based topics and it is nearly always the Geographers that are picking up GIS, as opposed to the other sciences e.g. biology.

There has been research, most notably by the Ordnance Survey through there Mapping News magazine that goes to all schools.

Two hundred and forty-three schools returned questionnaire forms. Twenty-eight of the schools were current users of GIS and two had given up using it. The rest were all non-users, but interestingly a third indicated that they planned to use GIS within one year, and two thirds within two years.

<http://www.ordnancesurvey.co.uk/oswebsite/education/mappingnews/previous-editions/27/Gis%20in%20schools.pdf>

Other research includes MSc's in using GIS and understand "what works" in the classroom. There are two PhD's near completion (that I am aware of) on using GIS at Primary and at Secondary. Both PhD's have focused on the educational value of using GIS, building on BECTa's study.

There is no known other publicly available published research.

d) What resources are available to support GIS in schools?

TEXT BOOK - The Geographical Association and ESRI (UK) have just launched the first A-level GIS teaching resource. The new text book, exercises and software are designed to help A-level Geography teachers. The A-level (16-18yr olds) GIS teaching resource is entitled 'GIS for A-level Geography, written by Dr Peter O'Connor.'

Other publishers such as Folens are taking about creating a book for KS3 and KS4.

There are digital resources available from a number of sources but the main ones are RGS, GA and the OS which attempt to help teachers and pupils understand of GIS.

OS MAP ZONE - <http://mapzone.ordnancesurvey.co.uk/mapzone/>

OS Education - <http://www.ordnancesurvey.co.uk/oswebsite/education/>

RGS – <http://www.gis.rgs.org/>

GA –

<http://www.geography.org.uk/search.asp?searchfor=GIS&searchin=all+areas&x=0&y=0>

Teachers also play a role in developing resources;

Juicy Geography - <http://www.juicygeography.co.uk/>

e) Uses of GIS in the classroom

Plenty of good examples

RGS - <http://www.gis.rgs.org/classroomexemplar.html>

ESRI UK - <http://www.esriuk.com/industries/subindustry.asp?indID=34&SubID=150>

Knig Edward VI at Five Ways Schools -

http://www.ke5ways.bham.sch.uk/kegs/projects/school_environment.html

Digital Worlds – www.digitalworlds.co.uk

f) Training available for schools and teachers

There is no strategy or consistent attempt to train teachers in GIS. Occasionally, the GA and the RGS put on training courses. Some University's also participate with ad hock training on GIS for teachers but courses nearly always consist of the traditional academic “vector / raster” training which has little relevance to teachers and lack inspiration. These courses act as a barrier to GIS in schools rather than an enabler. The courses are often for free or less than £75

g) What are the needs of teachers?

This is a significant gap in the research. GIS is now in the English curriculum with little guidance, few resources and no research on what teachers actually need.

Anecdotally, most teachers request “easy to use” software bundled with maps/data and lesson plans that can be taken and used directly in the classroom.

h) Organisations promoting and using GIS and education

Digital Worlds www.digitalworlds.co.uk

ESRI UK www.esriuk.com

AEGIS www.aegisuk.net

Infomapping www.infomapper.com

All sell a type of GIS, with maps and data, ranging from simulation GIS, GIS designed specifically for teachers through to de facto industrial standard GIS.

The AGI is the professional association for GIS. They have an education section.

i) Any other information

GIS day is supported and promoted mainly by ESRI UK. Check out ESRI for more information www.esriuk.com/gisday/

Issues and Recommendations

As a result of this 'state of the art' report, when designing the iGuess teacher training course, the project team take account of the following issues:

- A lot of free software has low sustainability and supportability. Software changes very rapidly and is very variable.
The iGuess consortium will aim to create a course that is sustainable, with a planned life cycle of at least 3-5 years after the completion of the project
For sustainability and access, iGuess will offer access to exercises, examples and data as part of its training course via an online database.
- There are many likely teaching approaches which can be used. There are many different predominant cultural styles of teaching (and learning) across Europe.
The iGuess course will be developed so that it offers a number of different teaching and learning approaches to the classroom uses of GIS. This will vary from teacher-led methods to problem solving and project based techniques.
- For relevance, initial and continuous teacher and teacher training requires that examples should be closely linked to 'normal curriculum and teaching practice' in different countries.
As part of the iGuess training course, examples will be created which link closely to curriculum areas and teaching practices which are commonly found in most European countries.
- The needs of European education are very diverse. From short and simple activities to complex and lengthy exercises. The age range covered will also be extensive.
The iGuess course will offer materials with a range of complexity and for different age groups
The iGuess course will provide materials covering different curriculum areas, including interdisciplinary studies.
- ICT facilities and the computer skills of teachers are very variable.
In preparing materials, the iGuess training course will take note of the varied competences of teachers in using ICT
- GIS does not offer the same opportunities as Web-based applications.
iGuess considers that all European countries should enable teachers and schools to introduce and develop skills in using GIS

Annex: The European standard for GIS in Secondary Schools

Using geographical (spatial) information to make decisions and solve problems is important skills for all active, responsible EU citizens in the 21st Century. Developing such spatial literacy includes the availability of computer-based tools such as geographic information systems (GIS) which allows students to interact with data, answer questions and reflect critically using a geographic approach. They can also clearly communicate the results to a broader audience. Any efforts should result in the relevant and ethical uses of spatial information in this area should be coordinated with the e-Europe initiative.

Level Descriptor

Four fundamental goals of secondary education are important when considering what GIS should be studied in school Geography, these are to:

- Create digital earth citizens
- Prepare school leavers for higher education
- Increase employability opportunities and
- Encourage lifelong learning

A GIS component in a schools programme prepares school leavers who:

- can actively participate in public decision making use of spatial information and visualization
- understand the basic purpose and application of GIS to interdisciplinary real world problems
- can use GI interfaces to obtain geographic information in order to investigate and critically reflect on spatial phenomena
- are able to communicate the results of their investigations with the help of GI
- are aware of the ways of maintaining and building their own GI knowledge and skills

Learning Outcomes

At the end of secondary schooling, students will be able to:

- Critically read, interpret and produce cartographic displays in different media
 - Example: Analyse a map of a natural disaster seen on TV or a map of election results from a newspaper
 - Example: Analyse the power of maps
 - Example: Be aware of sources of information and their reliability
- Be aware of geographic information and its representation through GI and GIS.
 - Example: GPS, GIS, Internet interfaces

- Visually communicate geographic information
 - Example: Produce basic maps
- Describe and use examples of GI applications in daily life and in society
 - Example: GPS-related/locational (social networking), Google Earth
 - Example: Who are the people who use GIS professionally – emergency services, law enforcement, precision agriculture, environmental planning, military, civil engineering, transport, academic research
- Use **freely** available GI interfaces at a basic level
 - Example: Find your house in a digital earth browser
 - Example: Find and use data from your national data portal
 - Example: Find routes from school to home and back, get a topographical map for a walk
- Carry out basic data capture
 - Example: gather information from fieldwork studies
- Ask and answer geographical questions with the help of GI interfaces
 - Example: What changes have taken place ? In which direction?

Acronyms

GI - Geoinformation or geographic information, created by manipulating geographic (or spatial) data

GIS - Geographical Information Systems

GPS - Global Position System

This benchmark statement has been produced as a result of the HERODOT thematic network for Geography in higher education (www.herodot.net) meeting in May 2008 and then revised at meetings workshops and the AGIT and ESRI User Conferences until in July 2008 and at EUGISES in November 2008.