

eduGI.net
- International Network for
Education in Geographic Information Science –

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Abstract: The Institute for Geoinformatics (IfGI) of the University of Muenster has launched the project “eduGI.net”, targeting a closer international cooperation of institutes for geoinformatics in GI science education. Only the exchange of information, organization, contents, students, personnel, ideas, and experience can assure high international quality standards in education. The paper describes the objectives of eduGI.net, the results, and the forthcoming tasks.

1 Introduction

Geographic information (GI) is on the way to become a real business. This evokes the need for highly qualified personnel, in producing companies as well as in research. Universities are building blocks of this business: Their outputs are students, PhD, and professors doing research, and working as future employees and leaders in the GI market. On their capabilities depends the further growth of the GI market, and, in return, the further demand for institutes for geoinformatics.

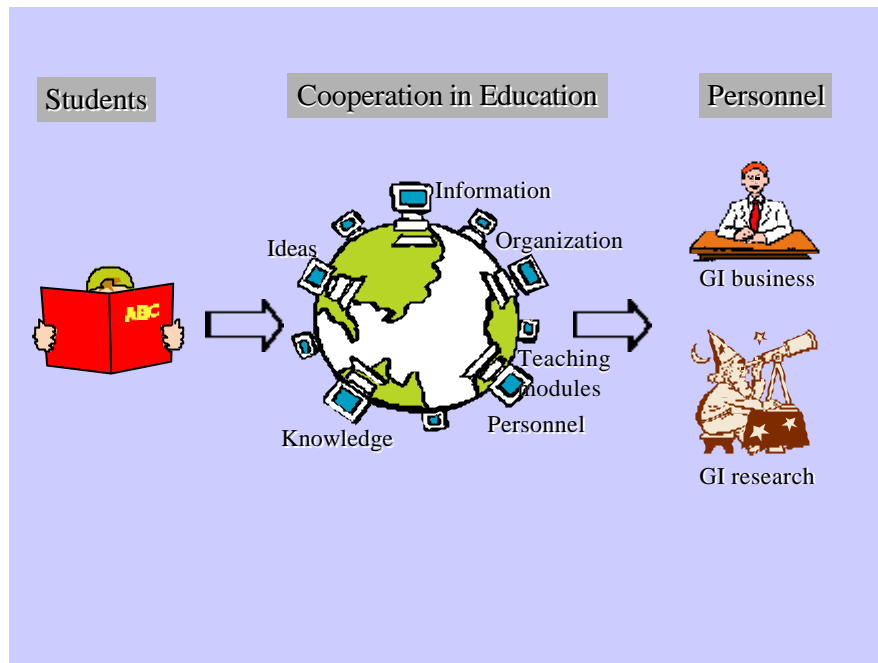


Fig. 1: The GI market needs education

GI is an international business. Many initiatives show the need and the success of an international cooperation in business and research, e.g., OpenGIS Consortium, Global Spatial Data Infrastructure (GSDI), Geographical Information Systems International Group (GISIG), and Association Geographic Information Laboratories Europe (AGILE).

The successful introduction of the curriculum in „Geoinformatics“ at the University of Muenster, as well as similar programs at other universities, suggest an institutionalized exchange program in education. Only the exchange of information, organization, contents, students, personnel, ideas, and experience can assure high international quality standards.

The internationalization of GI education started in many respects, e.g., the EC's Erasmus program for the exchange of students, the European seminar on GI education (EUGISES) of AGILE, and the occasional occupation of international personnel at many universities.

But if we have a look at our institute and many others, measures of internationalization are not as advanced as they could and should be. Concrete measures, e.g., exchange of students and personnel, the enhancement of English lectures, and the organization of an international summerschool, as well as the organizational requirements for executing measures, e.g., certification of courses, introduction of the European Credit Transfer System (ECTS), and harmonization of curricula, are not realized or only in single actions.

There is a need for a bottom-up approach of a practical cooperation of institutes for geoinformatics. eduGI.net (see <http://www.eduGI.net>) targets the internationalization

of the participating institutes for geoinformatics in a comprehensive approach. The eduGI.net partners work on the fulfillment of the organizational requirements of internationalization and the execution of concrete measures in direct contact and on low organizational level.

Only through an exchange of information, contents, students, and teachers can a curriculum meet international quality standards. eduGI.net targets sustainable networking for the purposes of

- More efficient use of resources
- Quality assurance in GI education
- Improved qualifications of university graduates.

The following section 2 describes the objectives and measures of eduGI.net. Subsections 2.1-2.7 give background information and suggest measures for implementation (“implementation plans”). Section 3 provides motivation, status quo, and benchmarks for the internationalization at IfGI. Section 4 describes partners, results and further activities of eduGI.net.

2 Objectives and measures

eduGI.net is a network of GI education institutions. It supports the fulfillment of organizational requirements and implements measures for cooperation as follows:

1. eduGI.net targets an increased *mobility of students* (Masters and PhD levels). The eduGI.net partners fulfill the organizational requirements for student exchanges and advertise and participate in mobility programs.
2. eduGI.net targets an increased *exchange of teachers* (professors and research assistants). Thus eduGI.net improves the quality of teaching, trains research assistants in international teaching, and enhances research cooperation. The eduGI.net partners fulfill the organizational requirements for teacher exchanges and participate in mobility programs.
3. eduGI.net establishes a series of *annual summer schools* for Masters and PhD students. A summer school counts as a course of studies for the students at their home universities. The events will be organized in turn by partner universities.
4. eduGI.net partners exchange information on *curricula* and *degrees*. A harmonization of curricular contents creates synergies and facilitates the exchange of students, teachers, and course modules. Where applicable, partners share experiences in introducing new degrees and achieving accreditation.
5. eduGI.net partners develop *standards for curricula and modules*, based on the European Credit Transfer System (ECTS). All partners guarantee a minimal number of courses taught in English.
6. eduGI.net develops an *organizational framework*, consisting of a management structure and working groups. For a sustainable cooperation, the network develops a business model. The partners seek funding from national and regional organizations, and jointly apply for international funding.

7. eduGI.net targets a streamlined *cooperation between European and non-European universities*. First steps are the cooperation with US universities within the EC program ISAP, and with Latin-American universities within the EC program ALFA. Additional programs will be discussed and evaluated.

The following sub-sections (implementation plans) provide background statements of the objectives of eduGI.net. Based on background statements IfGI suggests eduGI.net implementation measures, which currently are discussed by the eduGI.net partners.

2.1 International exchange of Master and PhD students

An international exchange of Master and PhD students is a key requirement of the improvement of students' skills. In addition, the personal contacts enhance the cooperation of the partner universities in education and research. The educational requirements for the exchange of students are described in sections 2.4-2.5. Besides this, there are psychological and organizational barriers of studying and living in a foreign country. The exchange requires advertising for concrete student mobility measures within each partner university and a contact point within the institute.

The enhancement of GI courses in English language facilitates the exchange of students (see section 2.5).

The easiest and best known funding opportunity is ERASMUS. It is a mass program, meaning that the EC funds little amounts for the mobility of many students. The advantage for the student is the status as an ERASMUS student. This means that there is no fee for studying and that the student is integrated in the university organization, e.g., housing, and language courses. Also known are the Marie Curie Fellowships, which provide European placements for pre- and post-doctoral researchers (<http://www.cordis.lu/improving/fellowships/home.htm>).

Yet there are numerous national and international organizations for mobility funding, which are hard to keep track of. The combined experience and knowledge of a partner network could provide more funding opportunities.

We suggest the following eduGI.net activities:

- Discuss and initiate mobility measures for academic year 2002/03
- Enhance in-house advertisement for students mobility and name a contact person at each partner university
- Exchange information concerning funding opportunities for students mobility
- Bilateral agreements between all eduGI.net partners
- Apply for ERASMUS-SM (students mobility) in September/October 2002 for year of study 2003/04.

2.2 Exchange of teachers

The exchange of teachers (professors, research assistants) improves the quality of teaching, and trains research assistants in international teaching. The personal

contacts of eduGI.net feed enhanced cooperation into common research activities. Typically, an exchange of teachers will be possible within short visits. The ERASMUS program funds teaching mobility with a minimum stay of one week and a minimum of eight teaching lessons. These lessons have to be integrated into the regular courses of studies.

The teacher exchange in one-week blocks can improve education within eduGI.net. For guest lecturers the effort for preparation is small, because the lessons can be the same as taught at home. Yet it improves the teaching offers at the inviting university by new topics, new approaches, and units in English language. While teaching eight hours within one week, there will be plenty of time for using the visit at a foreign university research, contacts, discussions, and tourist aspects. In return, the guest lecturer's university will get a free eight-hours teaching unit.

We suggest the following eduGI.net activities:

- Discuss and initiate mobility measures for academic year 2002/03
- Exchange information concerning funding opportunities for teachers mobility
- Bilateral agreements between all eduGI.net partners
- Apply for ERASMUS-TS (teachers mobility) in September/October 2002 for year of study 2003/04.

2.3 Annual summer school for Master and PhD students

Summer schools are successful instruments for the organization of high-quality teaching units. Summer schools intensively and effectively mediate research content and methodologies. The participants experience and learn to work in an international cooperation. First, summer school is targeted to master students (or final year students in non-consecutive curricula); to them it is a regular, certified course of studies. Second, summer school is targeted to PhD students, for which it is an event for qualification. The eduGI.net partners contribute with tutorials, lectures, and workshops. In addition, summer school can be used for an eduGI.net management meeting.

eduGI.net wants to establish an annual summer school for Master and PhD students. The events will be organized alternating by partner universities; the first summer school will take place in Muenster.

We suggest the following eduGI.net activities:

- Participation in the first summer school in Muenster, 2002
- Agree on annual summer schools, organized by eduGI.net partners
- Apply for ERASMUS-IP (intensive program) in September/October 2002 for year of study 2003/04
- Evaluate additional, national and international funding opportunities.

2.4 Harmonization of curriculum contents and introduction of Bachelor/Master degrees

The „Bologna-Declaration“ of 29 European countries

(<http://www.crue.upm.es/eurec/bolognaexplanation.htm>) reforms the structures of their higher education systems in a convergent way. The “Bologna-Declaration” has been executed by many states, e.g., in Germany bachelor and masters degrees are replacing the traditional non-consecutive curricula.

The *curriculum harmonization* is a basic means of educational cooperation and facilitates the exchange of students, personnel, and teaching modules. It assures quality against the background of the international state-of-the-art and new requirements. As David Rhind (AGILE conference 2001, see <http://agile.uni-muenster.de/Conference/Brno2001/Opening.pdf>) stated, GIS is breaking out of the hardware/software ghetto. A wide range of knowledge, awareness and skills (e.g., GI business, GI policy, and environmental or governmental applications) is needed on the part of those working with GIS. This requires a new generation of courses of studies.

One solution was realized within the Masters degree in Geographic Information (MGI) at City University (see www.soi.city.ac.uk/mgi) and could serve as a basic content of harmonized curricula.

Some top-level contents of MGI are:

- Geographic Information Science
- Fundamentals of Information Science
- Key GIS technologies and Java programming
- Information as a resource or asset
- Knowledge organization
- Business, professional and scientific practices involved in GI use
- Management and visualization of information
- Information law and policy
- Applications of GI use in geodemographics, epidemiology, insurance, transport, environment and government.

MGI offers transparency in its quality procedures, a comprehensive learning resource and pro-active student involvement (see D. Rhind, AGILE 2001).

The harmonization of contents within curricula leads to an organizational harmonization within the *introduction of bachelor and masters degrees*. In Germany and other countries, the need of universities for internationalization has led to the political consequence of slowly abolishing the traditional system of diploma. New curricula have to be adapted to the bachelor and masters degrees.

The quality of curricula is assured by *accreditation*. In the US this procedure is well established, e.g., by the IEEE/ ABET (Institute of Electrical and Electronics Engineers, Inc./Accreditation Board for Engineering and Technology, Inc., see <http://www.ieee.org/organizations/eab/apc/overview.htm>). ABET is a federation of 31 engineering, professional and technical societies and is recognized by the Council on Higher Education Accreditation (CHEA) to accredit programs in engineering, engineering technology, computing science, and applied science programs within the United States. IEEE is the largest of ABET’s societies.

In Germany, new curricula are subject to a similar accreditation procedure (see www.akkreditierungsrat.de). Criteria for admission are:

- Requirements of quality and internationality of the curriculum concerning content, course of studies, and organization.

- Career opportunities for Bachelors and Masters
- Potential of personnel
- Equipment of university
- Requirements for admission to master curricula
- Coherence of curricular concepts with qualification for careers in the private and public sector
- Transition from traditional to new curriculum.

There is an international cooperation of accreditation organizations, but yet there are no common standards.

For the harmonization of curricula content we suggest to exchange information on the status quo, and to discuss and elaborate a concept of harmonization, based on the MGI content.

Activities for the introduction of bachelor/masters degrees and accreditation depend on the situation of each partner university. We suggest a cooperation of those eduGI.net partners, who have introduced or will introduce new curricula:

- Exchange information on the status quo, experiences with introduction, and strategic plans
- Develop plans for introduction of new curricula and accreditation
- Possibly: Apply for ERASMUS/PROG (funding of curriculum development) and ERASMUS/DISS (funding of introduction of curricula/courses of studies) in September/October 2002 for year of study 2003/04.

2.5 Certificated courses of studies and modules and introduction of ECTS (European Credit Transfer System)

A. Certificated courses of studies are a core requirement for the exchange of students. Its basis is the introduction of ECTS (European Credit Transfer System). ECTS credits target the *quantity* of courses of studies. All courses of studies and other students' activities required by the university's curriculum add up to 60 credits per year. The students' workload is estimated by 45 working weeks per year, which equals 1800 working hours per year or 30 working hours per credit (standard in Germany, differences in other countries). In addition, the *quality* of courses of studies is standardized, yet the standards are quite weak. They require teaching modules; meaning thematically focused teaching units of four to ten semester hours, finalized by some kind of success control. Still for each student exchange both universities have to compare and assure the quality in an extensive case-to-case procedure (bilateral learning agreements, transcripts of records).

The first goal within eduGI.net is to organize the certification of all partners' courses of studies on the basis of ECTS. The second goal is to achieve an automatic certification by common standards within the network. Standards could be:

- The course is classified within ECTS (European Credit Transfer Systems), 1 credit equals a workload of 30 hours of lectures, seminars, work on a project, and homework.
- The content is the state-of-the-art of a topic, based on recent publications, and current research and project experience.

- The students are graded by
 - Participation in the lessons
 - Short presentations
 - Work on a mini-project. Result: paper, minimum 4 pages, in order to solve a problem (theme, goals, problem statement, methods, results, discussion and outlook).

An additional barrier for student exchange is language. For example, a German student going to Italy has to learn or improve two languages at one time: Italian as the language of the courses of studies and English as the language of GI science. Therefore, an increase of GI courses in English language at each partner university is needed.

The network provides the opportunity to use resources more effectively by an exchange:

- For traditional courses, documentation is available in the Internet for eduGI.net partners:
 - Syllabus
 - Concepts of lessons
 - Materials (publications, slides for lessons, information about used software)
 - Student work (slides of lectures, papers).
- New Internet-based media and teaching units are shared and/or developed.
- An exchange of courses of studies is targeted, e.g., a teacher of University A teaches a one-week block seminar at University B, and the other way around (see section 2.2).

We suggest the following eduGI.net activities:

- Exchange information on the status quo of ECTS, and strategic plans, and, if applicable, experiences with introduction
- For those partners who plan to introduce ECTS: apply for funding with the ERASMUS program (September/October 2002)
- Establish multilateral learning agreements between partner universities
- Develop standards for courses of studies certificated by all partners
- Initiate an increase of the number of courses in English language
- Exchange resources by the provision of information (concept, materials, documentation, quality standards, and evaluation of the international courses of studies)
- Possibly: Apply for ERASMUS/MOD (funding of module development) in September/October 2002 for year of study 2003/04
- Initiate an exchange of courses of studies, e.g., a teacher of University A executes a one-week block seminar at University B, and the other way around.

2.6 Organizational framework and conception of a business model

eduGI.net develops an organizational framework for a sustainable cooperation.

Within the formal establishment of eduGI.net the partners create a management and decision structure and organize common activities. A sustainable cooperation of the network requires the conception of a business model. A key issue is to acquire national and international funding opportunities. The eduGI.net partners evaluate and apply for their specific national and regional funding organizations, and commonly apply for international funding, i.e., EC programs.

eduGI.net is based on voluntary work on those objectives that are relevant to each partner university. The organizational framework is kept simple. As for the management and decision structure we suggest:

- Management meetings take place once a year, e.g., in combination with summer school or conferences as AGILE.
- eduGI.net is open to new partners without a special process for membership application.
- For information and coordination, proposals for new activities, and evaluation of and application for funding opportunities, we suggest establishing a sustainable coordination agent.

The organizational framework and the business model of eduGI.net has to be discussed and agreed on by all partners. We suggest to

- apply for national funding opportunities by each partner
- apply for a network funding within EC's 6th Framework program.

2.7 Cooperation to with non-European universities

eduGI.net targets an extended cooperation with non-European universities. First steps are the cooperation with US universities within the ISAP program (<http://www.uni-muenster.de/Auslandsamt/Programme/ISAP.html>), and to Latin-American universities within the EC program ALFA (<http://www.alfa-program.com/uk/entrada.htm>). Additional cooperation has to be discussed and evaluated.

We suggest the following eduGI.net activities:

- Exchange information on the status quo of cooperation and strategic plans
- Participation of one more European university within ALFA
- Initiate further cooperation.

3 Internationalization at IfGI

The project start of eduGI.net led to an internal analysis of the status quo and strategic goals of the internationalization at IfGI. Currently, IfGI has many international contacts in research and business, and participates in various international networks. The cooperation in GI science education has to be improved. IfGI has introduced the first University curriculum "Geoinformatics" in Germany. We offer some courses of study in English. But yet there are only a few international students and the course contents need to be provided internationally. The main

impediment is the lacking fulfillment of organizational requirements for internationalization.

For an advanced internationalization, we have internally defined the following strategic goals and benchmarks:

Tab. 1: Strategic goals and benchmarks for internationalization at IfGI

Strategic goals	Benchmarks (minimal achievements)
Sustainable framework of international cooperation in GI Science with European, US, and Latin-American universities	<ol style="list-style-type: none"> 1. Foundation of eduGI.net, April 2002 2. Agreements of cooperation with two US universities within ISAP, April 2002 3. Initiation of Latin-American cooperation with three universities within ALFA program, April 2002
Development of International up-to-date curricular contents	<ol style="list-style-type: none"> 1. Adaptation of teaching goals to top level contents of MGI (see D. Rhind, AGILE 2001), April 2002 2. Concept for harmonization with eduGI.net partners, June 2002
Introduction of bachelor/masters degrees and accreditation of curriculum	Apply for admission at university, September 2002
Introduction of credit transfer systems	<ol style="list-style-type: none"> 1. Plan for European Credit Transfer System (ECTS) introduction, December 2001 2. Unofficial introduction of ECTS, March 2002 3. EU-proposal (Erasmus) for official introduction, September 2002
Exchange of students	<ol style="list-style-type: none"> 1. English courses for a total of 30 ECTS credits in one semester of the year 2002/2003 2. Six foreign GI students in WS 2002/2003 3. Six GI students sent abroad in WS 2002/2003
Exchange of personnel	<ol style="list-style-type: none"> 1. Two guest lecturers with one one-week course at IfGI (each) in WS 2002/2003 2. Two guest lecturers with one one-week course abroad in WS 2002/2003
Exchange of courses and modules	Concept (December 2001) and realization of one International course, WS 2002/2003
Establishment of a regular summerschool	Realization of two-week summerschool for students and post-graduates, August 2002

4 Results and work plan

eduGI.net started in October 2001. University of Muenster supports IfGI within its internal program for internationalization until December 2002.

A first round of bilateral talks revealed enthusiasm and readiness to pursue the proposed collaboration. In particular, there is a broad recognition for the potential synergy in curriculum development, adaptation, and shared teaching. Currently, seven institutes for geoinformatics or similar organizations participate in eduGI.net:

- Cartography Laboratory, Department of Rural and Surveying Engineering, National Technical University of Athens, Greece (expression of interest)
- Department of Earth Sciences, Uppsala University, Sweden
- GIScience Lab, Department of Geography, University of Zurich, Switzerland
- Department of Geoinformation, Technical University of Vienna, Austria
- Higher Institute for Statistics and Information Management, New Technologies Laboratory, New University of Lisbon, Portugal
- Information Systems Department, University Jaume I, Castellón, Spain
- Institute for Geography and Regional Science, University of Klagenfurt, Austria
- Institute for Geoinformatics, University of Muenster, Germany.

IfGI provided a Memorandum of Understanding for eduGI.net (see www.eduGI.net). It describes the mission of the targeted network, its objectives, and how it's realization proceeds. A consensus of the eduGI.net partners on this concept was the first step of the network foundation. Currently, the implementation plans (see sections 2.1-2.7) are improved by personal discussions of IfGI with all partners. A consensus on implementation plans is the basis for the formal establishment.

eduGI.net started with concrete measures of realization. IfGI invited the eduGI.net partners for the first summer school, taking place in Muenster. eduGI.net partners signed a bilateral agreements and agreed on an exchange of students and personnel in winter semester 2002/03, funded within the EC program ERASMUS. In addition, ISAP program granted a funding the cooperation with the University of Idaho. The application for cooperation with Latin-American universities within the ALFA program is in preparation, as well as the exchange of teachers and one-week teaching units.

Currently, we plan the following steps:

- Consensus on implementation plans (04/2002)
- Formal establishment of eduGI.net (04/2002)
- Applying for ALFA program for cooperation with Latin-American universities (04/2002)
- First summer school in Muenster, Germany (07-08/2002)
- Acquiring more partner universities (ongoing)
- Applying for funding (ongoing).

5 Authors' coordinates

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