FIG Educational Portal – A Method and User Interface to Manage Surveying Educational Curricula

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ABSTRACT

University curricula in surveying differ from one country to another. The differences appear both in the structure and the educational levels as well as in the contents. Surveying curricula can be measurement/geodesy oriented, land management/business oriented or nowadays even geoinformatics/information technology oriented. In some cultures surveying is a practical profession, not so much a field of academic science. However, there is a strong pressure to give more emphasis on scientific research and development. This pressure comes, among others, from information technology oriented instruments and technology as well as the growing role of spatial information management and spatial infrastructures in the society in whole.

FIG Commission 2 has been working for several years on topics associated with university curricula description as well as development of learning and teaching methods. Surveying Educational Database is a collection of surveying curricula descriptions and the web sites of the Educational Members of FIG that are linked to FIG site give an easy access even to virtual universities. However more systematic approach to the management of educational metadata and materials is needed.

In this article we introduce the concept of Surveying Educational Portal that could be one solution. Surveying Educational Portal is based on distributed data management organized by the individual universities. The primary requirement is that universities have web sites in Internet and that they publish information on their courses based on professional keywords. Information retrieval is based on automatic search engines and created user profiles. User profiles can be created by universities as the metadata description of their curricula or for example by a student or teacher for a temporary use. User profile is the central tool of SEP and it is based on the collection of keywords that make the lowest level of curricula description.

In Commission 2 a prototype has been created for introducing the principles of SEP as well as in order to better define the user requirements and design the implementation. The prototype is described in another article in this Congress.

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1. INTRODUCTION

In the FIG Commission 2, Professional Education, surveying university curricula has for a long time been a topic that creates enthusiastic opinions and several different views on both the contents and the structure of curriculum. In order to manage the great variety of curricula the Surveying Educational Database (SEDB) was designed and implemented, first as a file based version delivered on diskettes and finally as a database version accessible in Internet via the FIG web site. The SEDB includes several hundreds educational programs and gives short descriptions on the organization and contents of the education. However, problems arise in keeping the database up-to-date.

Surveyors´ curricula have also been dealt with by the CLGE (Comité de Liaison des Géomètres-Experts Européens). After the so-called Allan´s report the work has been continuing around the concept of surveyors core curriculum. The idea of core curriculum is to collect the educational topics that are present in all surveying curricula and that also should be there. However, in the meeting in Delft (November 2000) it was finally agreed that no such core curriculum can be described (not even in Europe), because educational programs differ too much both in the structure and in the contents in different countries. Professor Hans Mattsson had recently worked a lot in comparing European surveying educational programs and he could identify three models: The German model, the Swedish-Danish model and the Finnish-UK model. These models differ greatly in the balance between the main educational topics.

In the previously mentioned CLGE meeting it was then decided that no core curriculum can be defined. Professor Enemark proposed a so-called three-part-model that structures the educational contents into: surveying and measurement, land management and geoinformation management. His proposal was that this three-part-model could be accepted as a basis for describing and analysing surveying curricula.

In the FIG Seoul Congress Commission 2 had intensive discussions and also several good presentations that gave new ideas and finally led to a conclusion that was presented in the General Assembly. The final decision by the Commission for the future work on describing the curricula was that the existing SEDB that already is in the web must be reinforced by a collection of several other types of information delivery. In the field of surveying many universities have excellent web sites where information on courses, teachers, research topics etc. can be easily found. Also many universities have produced educational materials, books and other products, that could be linked to a web site. Some advanced universities even offer virtual courses that can be participated in distance in Internet. The actual proposal and plan was to design and to build a prototype of the Portal of Surveyors Education. This Portal would let access to SEDB, home pages of the academic members of FIG, Virtual Academy

applications and other relevant educational material. This prototype has been created and it will be also introduced and demonstrated during this Congress (Cöltekin, 2002).

2. DIFFERENT CURRICULA AND METHODS TO COMPARE THEM

Allan´s report

As mentioned in the Introduction, it has been realized by several groups and individuals during the recent years, that it is impossible to identify neither the core curriculum of surveying studies nor a common model for approaching the overall structure. The so-called Allan´s report (Allan, 1995) was the first big work made for describing different university programs in surveying. This work covered both M.Sc. and B.Sc. programs and was made for the 17 countries of Western Europe. In Allan´s report six main models has been identified: Geodetic Sciences option, Engineering option, Hydrographic option, Cadastral option, Planning option and Real Estate option. The different "options" characterize the field where the main emphasis lies in the curriculum in question. In Allan´s report all curricula are analysed according to a "pie diagram" with varying number of sectors representing educational topics. Sectors are divided into levels: elementary, core and advanced studies. The description was made in each university/country and Professor Allan travelled a lot while collecting all information. The report is an amazing document of the situation about ten years ago, but time has passed and the results are outdated.

Mattsson´s analysis

Professor Hans Mattsson (Mattsson, 2001) has continued on the basis of professor Allan´s work and compared the surveying curricula in Western European countries. New data was collected and reported – instead of circles in the form of tables. In comparison Mattsson used the main subjects that were also in the updated Allan´s report: measurement, maps and GIS, law, planning and development, valuation, economic real estate management and construction and cost control. Curricula were mapped according to these topics and the specialization of each was then identified. Mattsson identifies three main types of specialization – three models: The Mapping and Surveying/Geodesy specialization model, The Land Management, Land Development and Cadaster specialization model and The Economic specialization model. What is new in Mattsson´s analysis compared with Allan´s is the growing role of information technology in the form of GIS, Geoinformatics or Geoinformation Science. In Mattsson´s analysis the big difference between European countries was recognized and even models like German model, Swedish-Danish model and Finnish-UK model were presented.

Enemark´s three-part-model

In CLGE meeting in November 2000 professor Enemark (Enemark,2001) proposed a three-part-model to be the basis for any analysis of surveying curricula. The model consists of the following parts: Measurement Science, Land Management and Spatial Information Management. Geoinformation management links the two others together and the three parts

lead to the surveyors profession that is, according to Enemark, “design/build/manage the natural/built environment and connected spatial/legal rights”. In its simplicity this three-part-model is very useful starting point for more detailed analysis of each university educational program.

Some other analyses – Commission 2 contribution

In FIG Seoul Congress technical program several presentations discussed the issue of describing curricula that widened the very Western European centred view of the previous models. For example surveyors´ curricula in Latin America (Cavero,2001), China (Liu,2001), US (Rouch,2001) and Poland (Adamek and Kaminski, 2001). Professor Psarianos from Greece gave also a very interesting presentation dealing with different profiles of non-geodetic surveyor (Psarianos, 2001). Without longer discussion on the different models and approaches the taxonomies of educational subjects in each presentation are given in the following:

Latin America: basic, technology, land administration, property, economy, law, humanities
North America: mathematics and science, photogrammetry, geodesy, land information systems, humanities and social science
Poland: geodesy, engineering surveying, underground and mining surveying, cadastre, cartography, photogrammetry and remote sensing, mathematics, physics, geometry, soil sciences, ecology, environment, sciences, methodology in geosciences, surveying data processing, computer sciences, sociology, languages, sport.

Even these examples show the variation between different models and also their description.

3. DESCRIPTION OF THE CURRICULA – REQUIREMENTS DEFINITION

Before making any proposal on how the different curricula should be described it is very useful to make a brief requirements analysis. Requirements analysis should be based on the users´ needs and the problems that are identified in the existing situation. In this case we thus have to make the following questions:

1. Who are the users who need the descriptions of surveyors curricula ?
2. For what purpose the users use the descriptions ?
3. What kind of information the users need on the curricula ?
4. How the users want to get the information ?
5. How important is the up-to-dateness and quality of the information ?
6. How important are the details of data, for example of course contents?
7. How important is it to be able to compare different curricula ?

Some answers for the previous questions:

1. Main users are surveying students and university/college teachers all over the world.
2. Students are searching for a university where to spend a year. Teachers want to get references when they develop their own educational contents. Teachers also look for

virtual (courses) that they could include in their own curriculum.

3. Students need to know the overall profile of the educational contents taught in the university and also they want to know in which topics the university has advanced research and educational programs. Teachers need to have as detailed descriptions of the courses and educational material as possible. Students might also want to attend virtual university courses.
4. Both students and teachers certainly use Internet.
5. Data must be up-to-date and correct.
6. Students might not need all details but teachers want to get as detailed data as possible.
7. Students want to search universities with a specified profile, for example remote sensing –oriented or GIS –oriented curricula.

In addition to the requirements the existing situation must be analysed and the biggest problems revealed. In this situation the so-called "existing situation" is a collection of updated Allan´s report and SEDB. In these systems the following problems can be easily identified:

1. Both the Allan´s report and SEDB are not up-to-date. Allan´s report was made in the mid 90´s, then it was updated but anyway the information is always just one cross-section. The problem is also serious with the SEDB because even when it is implemented as a digital database the persons who are responsible on updating the data are not all active. The result with SEDB is that a lot of data are missing, most of data are not up-to-date and even if they are the users can not rely on the general quality of the data. The motivation of the user is immediately lost if he/she founds that the information can not be relied.
2. The data that are stored into the SEDB do not reach the user needs. Statistics on education, personnel and students give a nice overview on the institute but that is not the information that is wanted. Instead of statistics detailed descriptions on the educational contents is required as well as real possibility to get materials and even to participate on virtual courses.
3. Educational programmes are so different that neither a core curriculum can be identified nor a common taxonomy of educational contents.
4. University staff is not permanent but changes from time to time. The system can not be based on corresponding persons and their responsibility.

The following levels of user requirements can be outlined:

LEVEL 1: General contact information is required.

LEVEL 2: Profiles of specializations and information on special strengths are required.

LEVEL 3: Detailed information - educational metadata - on course contents are required.

LEVEL 4: Approaches to virtual academy applications are required.

To make a conclusion of the user requirements we must make some priorities. It seems to be the first requirement that all data that are shown must be updated or at least the age of the data must be given. No data should be collected to any centralized database, but the solution should be based on a distributed data management and automated search from those systems. The system must include both the possibility to get generalized information of educational program profiles for comparison and also more detailed information directly form the web sites of each university. The system must be user friendly and possibly graphical/visual. We have to accept that for every university equal description can not be available – best universities that offer more also describe their curriculum well. Virtual academy development makes the need for curricula descriptions even more actual – metadata is required on offered courses.

5. THE PROPOSAL ON SURVEYING EDUCATIONAL PORTAL

Main principles

The proposal on Surveying Educational Portal (SEP) is still on very general level but the following principles can be stated:

1. Surveying Educational Portal is located in FIG web site, where any user can have free access – of course certain limitations in the access to virtual academy courses will be necessary.
2. Curricula descriptions will be based on a collection of keywords, the keywords will not make any core subset but rather a union of all possible educational items that are mentioned in any description of curriculum.
3. Every university can describe their own curriculum by using the given keywords and the result is the user profile of that university.
4. In SEP all data search is based on use of automatic search engine.

The use of Surveying Educational Portal

SEP offers tools for the user either to create his/her own user profile or then to use some of the ready made profiles. As an example in the prototype that has been built so far and documented in (Cöltekin,2002) the user profile of Helsinki University of Technology has been implemented. The user profile means the local definitions of certain subjects like Geodesy, Photogrammetry, Cartography, Remote Sensing and Geoinformatics. The definitions include a list of keywords (Cöltekin, 2002). This list describes the educational contents that is adopted in education in our university (HUT). Because in some other university the same subjects most probably have different emphasis these lists of keywords must be given by every user – and they define the user profiles. Universities are developing various metadata descriptions at the moment (Markus, 2000; Laurema & Virrantaus,2002) on their courses, both regular and virtual – the definition of user profiles is one way of describing educational contents, the metadata.

When a user wants to make a search, for example search for Geoinformatics courses offered in other universities, He or she must first create the user profile, the definition of the subject Geoinformatics, by selecting a subset of keywords in a list. When the definition is made it can be used in an automatic search and finally the profile can be stored. Another user might want to use it. User profiles do not change very often. At least they change more seldom than the courses. When user profiles are stored they can also be compared.

The main principle in SEP is to be based on the use of automatic search engines as much as possible. The key words must of course be defined and the user profiles created. But there can be a variety of them, not only one fixed model.

Technical implementation

According to the mentioned levels of different user requirements, also the technical implementations can be organized on levels, as follows:

> LEVEL 1: Contact information and general descriptions are already available in the SEDB. Even when not very up-to-date, data like names of universities, addresses and phone numbers do not change very often. This information can also be found in the web sites of the universities. All that is needed is links to the sites that can be located in SEP.
>
> LEVEL 2: The generalized profile information of educational programmes should be searched by using detailed descriptions. In this proposal we outline an automatic search engine that is able to use given keywords or in some other way show the specialization of the university. This search must be based on the distributed data storages in each university. Each university can provide their own user profiles – according to the previously described way – user profiles can also be created for one search only, by the student. University profiles can be stored so that users can use them for search. The tools for creating and storing user profiles are offered by the SEP.
>
> LEVEL 3: Detailed information of courses and educational programmes can be organized via the web sites of the universities directly. Also digital educational materials can be accessed via the web sites.
>
> LEVEL 4: Providing access to virtual academies can be organized via SEP.

The general solution of all different levels seem to be Internet based Educational Portal that integrates all descriptions and other materials as well as individual web sites. Surveying Educational Portal could be placed in FIG site and it will be available for members of FIG. In addition to the technical questions a lot of political, legal, organizational and cultural problems must be solved before the portal can be in use.

6. DEVELOPING THE METHOD FOR CURRICULA DESCRIPTION - CONCLUSIONS AND FUTURE PLANS

Commission 2 has been working on this problem during the ongoing four year period in the Working Group 2.3 "University curricula – content competencies, trends and assessments". The heritage for this WG in the beginning was SEDB in the file based format. The first effort was to implement a database version that could be used via Internet. Every university has now a password for on-line updating. However, as we have already mentioned, this procedure does not work, the corresponding persons at universities do not keep the data up-to-date.

The Working Group made a plan to collect as many descriptions of curricula as possible – from Europe, Asia, Africa, Latin America, North America – and then try to develop a method to analyse and compare them (Virrantaus, 2000; Virrantaus, 2001). Commission members have really been very active in this work, and in every Working Week technical program – Sun City, Prague, Seoul - we have had several presentations from different regions in the world. The idea was to collect material and then analyse it and try to find some rational way to approach them; this approach was decided during the Working Week in Prague.

The rationale that we finally decided to follow in Seoul was the decision between two approaches: after having a good collection of curricula descriptions and the taxonomies of educational topics either an intersection or a union of the taxonomies can be made. The intersection would mean the previously mentioned core curriculum and the union means that any topic mentioned in any curriculum will be taken into the list, only avoiding bad overlaps and analysing clear synonyms and homonyms. Our prototype on the Surveying Educational Portal will be based on the second approach.

In the prototype we have accepted as many keywords as technically possible, we have implemented the prototype on Geomatics side including Geodesy, Photogrammetry, Remote Sensing, Cartography and Geoinformatics/GIS. This limitations is thus, only for prototyping, the final version will, of course cover all fields of Surveying.

We have implemented a graphical user interface that will give the overview on educational specialization just by highlighting those keywords that are represented in each curriculum. The contents will be searched by using an automatic search engine. Arzu Cöltekin from Helsinki University of Technology has designed and implemented the prototype and it will be presented in her presentation in this conference (Cöltekin, 2002).

We hope in Commission 2 that this prototype will be further developed into a working system that covers all educational topics. At the moment the prototype has been implemented to work with 27 web sites of educational members of FIG. The system can take as many universities as possible into the search – the only limitation is that they must have a web site describing their curriculum in Internet.

This work will continue in the Working Group on Virtual Academy as well as in the Working Group on Curricula Models and CPD that seem to be continuing also during the chairmanship of professor Pedro Cavero. These working groups must be very closely co-operating because while the WG for Virtual Academy is developing the virtual applications and technology, WG on Curricula and CPD will deal with the educational contents. Both of these WG:s will come to the question of the educational items to be taught and they can not avoid co-

operating in the development of Seurveying Educational Portal.

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BIOGRAPHICAL NOTES

Kirsi Virrantaus is Professor in Cartography and Geoinformatics and Head of the Laboratory of Cartography and Geoinformatics at Helsinki University of Technology, Finland since 1988. She is Commission Chair of FIG Commission 2 Professional Education (1998-2002), Vice President (1999-2003) of ICA (International Cartographic Association). She has professional working experience in the National Land Survey in Finland (The Project for Multi Use of Land Information), the Geodetic Institute of Finland (Professor and Head of the Department of Cartography), Soil and Water Ltd. (Development engineer), experience in GIS consulting and project leadership in various national and international projects. At the moment she has written 83 scientific publication, supervised 110 graduate theses, 7 licentiate theses and 2 doctors theses on Geoinformatics/Cartography. Her current reserach activities are on design and implementation of GIS systems, spatial algorithms, spatial analysis and geographic visualization in Internet. She made her doctors thesis ”On Urban Land Information Systems – A Semantic Approach to Analysis and Design” in 1984; before that graduated as Architect in 1977. She was born in 1953, is married and has a family with four sons.

Henrik Haggrén is Professor in Photogrammetry and Head of the Institute of Photogrammetry and Remote Sensing at Helsinki University of Technology, Finland since 1994. He is former Chairman of Commission 6 on Engineering Surveys of FIG, 1992-1994. Currently he is chairing the FIG Working Group WG 2.2 on Virtual academy and distance learning. He also chairs the Working Group WG III/1 on Sensor Pose Estimation, International Society for Photogrammetry and Remote Sensing (ISPRS). His professional career has been on research and education, in 1972 - 1976 as Research and Teaching Assistant at Helsinki University of Technology, in 1976 - 1988 as Research Scientist at the Technical Research Centre of Finland (VTT), Section for Image Analysis and Remote Sensing, in 1988 - 1989 as Acting Professor in Photogrammetry, and in 1989 - 1994 as Research Scientist at Helsinki University of Technology, Institute of Photogrammetry and Remote Sensing. He has more than 100 publications in the field of photogrammetry and remote sensing. His current research activities are multidisciplinary, and fall in fields of applications in forestry, archaeology, or industrial manufacturing control, as well as of information theory for creative research organizations.