DEVELOPMENT OF A GATEWAY TO HIGHER EDUCATION THE EU PROJECT CUBER[1]

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Abstract: After a short description of some changes that the development of information and communication technologies (ICT) cause in higher education and vocational training, the EU project CUBER is described. The aim of this IST project is to build a database and a search engine for courses of European universities. Special emphasis will be put to distance learning courses and other educational offers that give learners some autonomy in time and/or location of learning. The system will support its users in the selection of courses that offer the desired degrees or skills and match their personal needs and preferences as well as their state of education. In the database the courses will be described by metadata based on the LOM standard.

Key words: ICT based education, Open distance learning (ODL), Search engines, Knowledge base, Metadata standards.

1 INFLUENCES OF INFORMATION AND COMMUNICATION TECHNOLOGIES ON HIGHER EDUCATION

Thinking of universities, most people have young students in mind, that live on a campus or in a city with a university and visit more or less regularly lectures, institutes or seminars. They may work to get some money for their subsistence, but their main "profession" is studying. According to this stereotype students come to the university after finishing school, they stay there for a while and leave the university with a final exam to find a job and start a career somewhere else, returning only for sentimental reasons to the place where they studied. These "classic" students form homogenous groups that have similar curricula that share many experiences and are able to discuss problems and solutions within their study and campus life. Most universities are adapted to this kind of students, providing sufficiently large facilities for lectures and seminars and − at least for the undergraduate students − a rather strict curriculum, that optimizes the use of these facilities during the semester.

However this type of education excludes students, that have restrictions in time or location and it is not very suitable for those that want to acquire one specific qualification without taking a complete study program; i. e. it is often not really adapted to part time students and people that are looking for vocational training. But the number of such people increases as will the demand for high qualification vocational training: More and more professions require relevant skills in domains with high change rates like information technology. The cycles of innovation are getting shorter, while the global competition increases. This means that "*just in time and just in place learning"* will become more important. This is a chance for universities that are able to satisfy this demand.

Some 20 years ago distance learning universities − like the FernUniversität Hagen − have been founded to offer students more flexibility in time and location of learning by means of self−instructional courses, flexible tutorial support, and fully accepted academic degrees. This gain in autonomy in time and location results in a loss of direct interaction among students and between students, teachers, and administration. Distance learning universities have to take this into account in various areas: administration, study programs and regulations, logistic, and − of course − in the way of teaching. Means to compensate the loss of social interaction are distributed study centers (like the "Studienzentren" of the FernUni Hagen), phases of face to face learning within a larger distance learning course and help desks that can be contacted by phone or e−mail, and web−based interactions

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like chats and newsgroups. Providing such services already for a long time, distance learning universities have broad experiences in some of the areas of *just in time and just in place learning* that can help to master the new challenges in this type of education. But their courses and study programs often have been and are still oriented at the traditional university education. Orientations towards vo−cational needs and life long learning are sometimes only slowly entering into the curricula of these universities.

The advances in information technology and the spread of the internet offer new ways of teaching and learning ranging from enhanced communication among students and between students and teachers over multimedia presentations, video transmitted lectures, interactive computer supported learning, simulations and virtual experiments, to virtual classrooms, video exams and CSCW (*com−puter supported cooperative work*) learning environments. The use of these options in universities − be they distance learning or traditional − is only at the very beginning; but the development is fast, especially in the Anglo−American and Australian regions. It is as well fast in the commercial and in−dustrial sector, for example in the form of corporate universities or of commercial providers of voca−tional training.

Some of the consequences of this process can already be anticipated. On the one hand side the costs for the preparation of computer supported learning material − for example a multimedia course presentation − are much higher than for a traditional lecture and teachers often will need support by specialists for the technical as well as for the didactic organization of the material. On the other hand the audience of a course is − at least for some forms − no longer limited, neither by the size of a lec−ture hall, nor by the distance to the university. Both these factors will lead to the development of courses that are shared by universities, with local tutoring support at each site, or with tutoring sup−port via the web. This process will weaken the relation of a student to "his" or "her" university − at least with regard to the origin of the courses he or she takes, it will widen the choice of courses a stu−dent has, and it will bring more competition to the educational "market".

Other options that ICT offers to course providers are modularization and personalization. Modularization means that a course, respectively the material of a course, is decomposed into smaller units that cover single topics within the domain of the course. If the relations to other units in the course and the prerequisites that are necessary to understand the unit are represented properly, these smaller units can either be offered as independent learning units or they can be reused in other courses. Personalization means that learning material is adapted to the specific needs and prerequisites of a specific learner.

However to use this potential of a wider choice, learners have to know about the existence of courses, their objectives and prerequisites and they have to be able to compare learning offers in a va−riety of dimensions.

2 THE CUBER PROJECT

The idea of the CUBER project is to build a system that allows users to search, find, and compare courses of several European universities and that supports them in the creation of a study program. To this end users have to be able to find courses that offer the desired skills or degrees and match their needs with regard to topic, content, objective, and learning preferences and workload as well as with regard to their present state of knowledge and legal status, their technical equipment and financial resources and their restriction in time and location.

To go in this direction a consortium of nine partners from eight European countries started a common project within the 5th Framework IST program of the European Union. The partners include pure distance education universities like the UOC in Barcelona and the Fernuniversität Hagen, uni−versities that offer on−campus and distance learning courses like the universities of Helsinki and Linz, the french national center for distance education (CNED) as well as associations like the European Association of Distance Teaching Universities, the Swiss foundation "Stiftung Fernstudien Schweiz" and EuroPACE 2000 at Leuven university in Belgium [1]. The project started in April 2000 and will run for 30 month. The database to be build in the project will include only courses in the domain of information technology mainly provided by the participating universities, but the system itself will be generic to cover other domains and other providers.

2.1 Finding ICT Based Courses on the Web

At present there are many pages of university courses online on the web in one or the other form. The content of the pages varies from short descriptions of lectures over link collections of additional material to a complete documentation of course material and manuscripts as well as more sophisticated interactive learning and simulation systems. Searching for such course pages with one of the major search engines like AltaVista is difficult, because the query has to specify on the one hand side the topic of the course, on the other hand side it has to specify that one is looking for courses and not for other pages on that topic. This often ends up in the typical precision − recall dilemma, i. e. either there are too many non relevant hits in the result or too many relevant pages are missed by the search. To get more detailed information on the courses − like teaching method, difficulty level, or other aspects mentioned above, one has to manually inspect the pages found. But even with this effort much of the information needed will not be available, because the courses and materials are not described in a common standard and learners are left with a mess of very heterogeneous descriptions.

Based on this observation CUBER will use a common format for the description of courses and will store course information in a uniform way based on this format. This will simplify the comparison of courses and will allow much more precise searches based on the standardized descriptions.

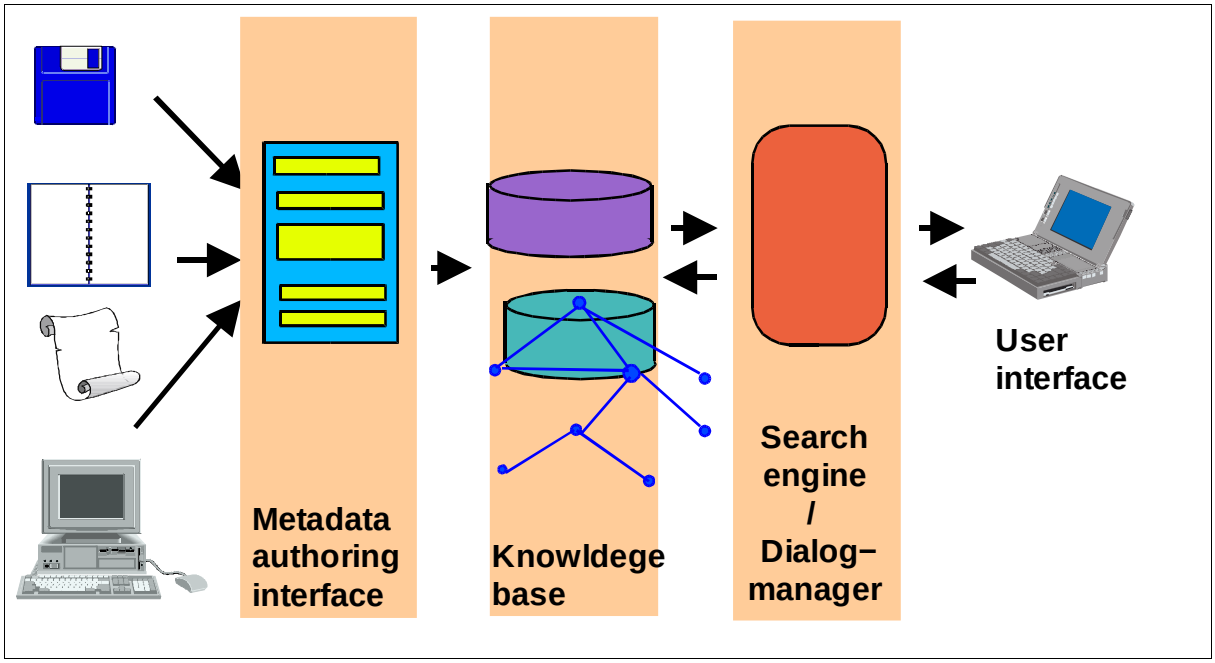

Figure 1: Overall Architecture of CUBER

2.2 CUBER Architecture

The overall architecture of CUBER is given in Figure 1. It shows the three main technical components: in the center the knowledgebase that stores the information on courses − i. e. the *meta−data* of courses, not the courses themselves or the material used in the courses − as well as the additional knowledge to support searches like classification systems, thesauri, or simply descriptions of the single fields within the course metadata. It will be fed by an authoring interface that supports the generation of course descriptions by checking the types of entries, provision of selections of terms from restricted vocabularies and by checks for coherence and completeness. On the right hand side the search engine and dialogue management system is shown. It will mediate between the users searching for courses and the knowledgebase. It will allow to specify detailed structured queries to the course database in order to find courses that match the users needs in the before mentioned dimensions. The specification will be supported by the additional knowledge stored in the knowledgebase. To make searching easier for new users templates for various types of searches will be provided; to support repeated use, user profiles will be stored. To achieve a high usability of the search engine the behavior of users in comparable search situations is studied at the beginning of the project and additional

evaluation studies will be carried out throughout the project duration. The design and implementation of the system will be based on the results of these studies.

2.3 Metadata Scheme

Beside the technical implementation the content and structure of the course metadata is of central importance for the ability to select and compare courses and to match them to the users needs, especially if they are from different providers. To achieve high interoperability with other systems and providers these descriptions should be based as far as possible on international standards or defacto standards. One of the important standards in the area of education is LOM, the IEEE standard on *Learning Objects Metadata* [2]. It describes course materials in a hierarchical structure that is grouped into nine top level categories: *General*, *Life Cycle*, *Meta MetaData*, *Technical*, *Educational*, *Rights*, *Relation*, *Annotation*, *Classification*. Within these categories more detailed descriptions are provided further down in the hierarchy.

However LOM is a standard to describe (digital) learning objects, it is not a standard to de− scribe courses. It does for example not provide an element to describe the time and location a course takes place (in case that this is applicable for example for examinations, for courses that include face to face periods, or for summer schools), the type of examination, the tutoring offered, or the means of communication among participants and with the organizers of the course. Further it does not define means to describe modules within one object or − to put it the other way round − to combine diverse learning materials to one course. This means that to use LOM within CUBER it will be necessary to enrich it by the necessary elements and to embed it into a standard to describe courses. This has to be done in such a way that interoperability is affected as little as possible.

Another specific problem is the accreditation of courses, i. e. the question if a course is ac− cepted by other universities within a study program. This is to a large degree a political and a legal question and can therefore not really be solved in a technology oriented project like CUBER. How− ever CUBER will include a study on the usability of the *European Credit Transfer System* [ECTS] for a more "predefined" acceptance of courses among the participating universities. It will provide the technical means to support the mutual acceptance of credits as far as possible.

3. PERSPECTIVE AND VISION

The perspectives of CUBER go beyond the partners of the present consortium and beyond the domain of information technology. As a vision future learners − regardless if they are students, pro− fessionals looking for vocational training, or citizens interested in life long learning − will be able to select from the offers of universities and other providers all types of courses from short briefings on a specific problem in engineering or a training unit for a piece of software to complete study programs, that match their preferences with regard to time and location, to method and speed of teaching, to educational and technical prerequisites, as well as to required resources and the credits offered. They will be able to combine these courses freely into units of higher education and life long learning and can use the broker system to guide them through their studies, taking into account what they have al− ready achieved.

Literature

[1] CUBER web site: http://www.cuber.net/
[2] LTSC: Learning Object Metadata Standard (LOM), Draft, January 2000: http://ltsc.ieee.org/doc/wg12/LOM−WD3.htm