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Description:	
Report on the developments in data management and especially database technologies reflected in the international curricula of ACM, and in curricula and course syllabi of a sample of European educational institutions, especially at the inner and OC partner institutions of DBTech EXT, and adaptation of DBTech Pro Framework of courses at the partner institutions.	

Curricula Report

This report describes a selection of international curricula in ICT with the special emphasis on data management, database technologies, and its application in information systems.

First we give an overview of the curricula from ACM, DBTech Pro, and the partners of DBTech EXT. Next is an analysis of these curricula with the focus on data and information management. A special emphasis is on the degree to which the DBTech Pro framework of reference courses and topics was implemented in the partner's institutions.

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1. Overview of data management and database technology in ICT curricula

1.1 DBTech Pro Framework

The DBTech Pro framework Dimitris A. Dervos. WP4: Content Planning. DBTech Pro Project, WP4 Final Report, 2004, DBTech Pro FIN-02-B-F-PP-126706 is a multidimensional reference model for the higher education in data- and information management and analysis. This framework was developed during the DBTech Pro project and updated in the current project. The framework differentiates and organises its topics along the dimensions

- Knowledge domain
- Cognitive level
- Professional roles/profiles
- Curriculum implementation

Different ***professional roles/profiles*** have been identified, like database designer, programmer, administrator, and compared with the relevant ACM and European recommendations. The recommendation was implemented to a certain degree at the partners' institutions depending on the diploma level and in accordance to the Bologna process.

The ***knowledge domain*** was divided into

- Principles of Database Systems
- DBMS Technologies
- Data Access Technologies
- Database Design (Methodologies)
- DBMS Administration

- Data Warehousing
- Data Mining
- Advanced Topics

The ***cognitive levels*** (see Bloom's Taxonomy Bloom, B., Englehart, M. Furst, E., Hill, W., & Krathwohl, D. (1956). Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain. New York, Toronto: Longmans, Green., see also: http://chiron.valdosta.edu/whuitt/col/cogsys/bloom.html) were

- Knowledge
- Comprehension
- Application
- Analysis
- Synthesis
- Evaluation

1.2 ACM curricula recommendations

The Association for Computing Machinery (ACM), the Association for Information Systems (AIS), and the IEEE Computer Society produced model curricula and guidelines for degree programs in Information Systems (IS2002) John T. Gorgone, Gordon B. Davis, Joseph S. Valacich, Heikki Topi, David L. Feinstein, Herbert E. Longenecker, Jr. IS 2002 - Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems, Association for Computing Machinery (ACM), Association for Information Systems (AIS), Association of Information Technology Professionals (AITP), Computer Science (CS2008) Computer Science Curriculum 2008: An Interim Revision of CS 2001, Report from the Interim Review Task Force, Association for Computing Machinery, IEEE Computer Society, December 2008, Computer Engineering (CE2004) Computer Engineering 2004 - Curriculum Guidelines for Undergraduate Degree Programs in Computer Engineering, A Report in the Computing Curricula Series, Joint Task Force on Computer Engineering Curricula, IEEE Computer Society, Association for Computing Machinery, 2004 December 12, Information Technology (IT2008) Barry M.

Lunt (Chair), Joseph J. Ekstrom, Sandra Gorka, Gregory Hislop, Reza Kamali, Eydie Lawson, Richard LeBlanc, Jacob Miller, Han Reichgelt. Information Technology, Curriculum Guidelines for Undergraduate Degree Programs in Information Technology, Association for Computing Machinery (ACM), IEEE Computer Society, 2008, and Software Engineering (SE2004) Software Engineering 2004 - Curriculum Guidelines for Undergraduate Degree Programs in Software Engineering, The Joint Task Force on Computing Curricula, IEEE Computer Society, Association for Computing Machinery, August 23, 2004 that contain courses related to the DBTech framework of courses. A body of knowledge is defined for each curriculum consisting of topics to be taught at some level of competency.

The curricular model has four competency layers: introductory, transition, intermediate, and advanced.

The architecture of each curriculum is given as a block diagram and partially individual course content is listed and argued in detail. The recommendations list representative capabilities and knowledge expected for the programs' graduates. Transition paths to migrate from preparatory courses to a degree program are pointed out in separate papers. Finally, pedagogic issues in software engineering like "imperative first" vs. "objects first" approaches are largely discussed. The knowledge units give departments the flexibility to develop unique curricula; however, the report provides more structure for departments that want such guidance.

In total, the ACM curricula are in depth worked out recommendations that are updated on a regular basis. However, some promises like the Computing Curricula 2001 Overview intended to focus on computing education as a whole was never published.

The Computer Science 2008 curriculum is an interim revision of CS 2001 and still in draft state.

1.3 A.T.E.I. Thessaloniki ICT curricula

The Department of Information Technology (IT) is one of the six Departments of the School of Technological Applications (S.T.EF.) offering B.Sc. degrees to its students. The IT department awards the title of Information Technology Engineer. With regard to the curriculum the department is divided in two divisions: the Division of Analysis & Programming and the Division of Systems & Computer Technology. Course modules of the ***Analysis & Programming*** Division N.N. Course Board, Information Technology Department, Αλεξάνδρειο Τεχνολογικό Εκπαιδευτικό Ίδρυμα Θεσσαλονίκης (Alexander Technological Educational Institute Thessaloniki), URL: http://www.it.teithe.gr/modules/courses/ (08.03.2010) are:

- Computer Programming I + II
- Business Management-Administration and Business Economics
- Numerical Analysis & Scientific Applications
- Information Systems I + II
- Operational Research
- User Interface Development
- Programming Methodologies I + II
- Internet applications programming
- Techniques for Approaching the Labour Market
- Software Applications programming and management
- Special Topics of Information Systems
- Neural Networks
- Computer Graphics
- Software Quality Assurance
- Management Information Systems
- E-Learning

The Division of ***Systems & Computer Technology*** offers the following courses:

- Introduction to Informatics
- Digital Systems
- Mathematical Analysis
- Communication Skills
- English I + II (Optional)
- Computer Organization and Architecture
- Discrete Mathematics
- English Terminology
- Data Structures
- Operating Systems I + II
- Probability Theory and Statistics
- Databases I + II
- Telecommunication and Computer Networks
- Artificial Intelligence
- Computer Networks
- Multimedia Technology
- Specific Topics of Artificial Intelligence
- Parallel and Distributed Systems
- Signal and Image Processing
- Special Topics of Database Systems
- Intelligent Systems
- Special Topics of Networking I + II
- Advanced Computer Architecture
- E-Commerce
- Information Systems Security
- Languages and Compilers

The courses are taught in an eight semester study programme.

1.4 Haaga-Helia ICT curricula

HAAGA-HELIA offers the following study programmes relevant for this report: Business Administration (Bachelor, Master), ICT (Bachelor), Communication (Bachelor), Information Systems (Master), and an Information Technology (IT) programme taught in English language.
The ICT Bachelor programme consists of the following course modules that are relevant for the DBTech framework:

- Basics of Database Systems and SQL, ICT1TD003 "Tieto ja tiedon varastointi" Martti Laiho, Basics of Database Systems and SQL, ICT1TD003 "Tieto ja tiedon varastointi", Haaga-Helia, 2010
- Introduction to Data Access Technologies, ICT4TD023C "Tiedon hyödyntäminen Martti Laiho, Introduction to Data Access Technologies, ICT4TD023C "Tiedon hyödyntäminen", Haaga-Helia, 2010
- Introduction to Database Administration, ICT4TD023B "Tietokantahallinta Martti Laiho, Introduction to Database Administration, ICT4TD023B "Tietokantahallinta", Haaga-Helia, 2010
- Introduction to Database Design, ICT4TD023A "Tietokantasuunnittelu" Martti Laiho, Introduction to Database Designing, ICT4TD023A "Tietokantasuunnittelu"Haaga-Helia, 2010

In the Information Technology programme, taught in English, the 2nd & 3rd semester courses are compulsory. The two courses Kari Silpiö, Developing a Web Application, ITP1TF012, Haaga-Helia, 2009 Kari Silpiö, Developing an e-Business Application, ITP1TF013, Haaga-Helia, 2009 embed database topics in a larger course that has a comprehensive case study Kari Silpiö, Database Project, ITP4TF105, Haaga-Helia, 2009 assignment (a Web application including a small database). Classes (contact hours) consist of 50% lectures and 50% lab work. During the last part

of the course all contact hours are lab hours for completing the case assignment. The 4th semester course is an elective course on databases. Classes (contact hours) consist of 50% lectures and 50% lab work.
The Bachelor programme in ICT contains in the 2nd semester a course on the basics of Database Systems and SQL and in the 6th semester the following courses related to DBTech: Introduction to Data Access Technologies, Introduction to Database Administration, and Database Design.
The professional courses will be merged into application development projects in the future.

1.5 Helsinki Business College

Helsinki Business College offers two international study programmes that have database related courses in their curricula:

- User Support
- Software Production

Both programmes contain the mandatory course Database and Network Administration and Maintenance. Students that have chosen the study programme “User Support” will enrol in Service Oriented Database Maintenance. However, students following the study programme “Software Production” take courses in Database Modelling from Requirement Specification, Relational Databases, Entity-Relationship Modelling, Relational Database Schema Design, Database Access, and SQL Queries.

In addition to the above, students have the choice of some optional courses related to database studies.

1.6 Reutlingen University ICT curricula

The School of Informatics delivers two ASIIN accredited study programmes on Bachelor and Master levels: Business Informatics and Media- and Communication Informatics N.N. Modulhandbuch Teil B für den Studiengang Wirtschaftsinformatik (WI) – Bachelor, Akkreditierung Fakultät Informatik, Hochschule

Reutlingen, 2008N.N. Modulhandbuch Teil B für den Studiengang Wirtschaftsinformatik (WI) – Master, Akkreditierung Fakultät Informatik, Hochschule Reutlingen, 2008 N.N. Modulhandbuch Teil B für den Studiengang Medien- und Kommunikationsinformatik (MKI) – Bachelor, Akkreditierung Fakultät Informatik, Hochschule Reutlingen, 2008N.N. Modulhandbuch Teil B für den Studiengang Medien- und Kommunikationsinformatik (MKI) – Master, Akkreditierung Fakultät Informatik, Hochschule Reutlingen, 2008. The study duration is 6 semesters for the Bachelor and 4 semesters for the Master programme. The intersecting courses of both programmes are in the field of Informatics. Among them, database technologies are central topics.

The modules in Business Informatics N.N. Modulübersicht, Wirtschaftsinformatik (Business Informatics), Fakultät Informatik (School of Informatics), Reutlingen University, 2010, URL: http://www.inf.hochschule-reutlingen.de/wi_uebersicht.html are:

(Bachelor)

- Introduction to Business Informatics
- Mathematics
- Programming, Algorithms, Data Structures
- Software Engineering
- Production Engineering
- Financing
- Accounting
- Databases
- Project Engineering
- Enterprise Modelling
- Distributed Systems
- Networks and Operating Systems
- Management
- Study Project in Industry
- Specialisation modules (facultative)
- Bachelor Thesis

(Master)

- Foundation of Informatics
- International Management
- Advanced Information Technologies
- Business Integration and Communication
- One Year Project
- Data Warehousing, Data Mining
- Knowledge Management
- Software Architectures and Technologies
- Research Topics (facultative)
- Master-Thesis

Media- and Communication Informatics N.N. Modulübersicht, Medien und Kommunikationsinformatik (Media and Communication Informatics), Fakultät Informatik (School of Informatics), Reutlingen University, 2010, URL: http://www.inf.hochschule-reutlingen.de/mki_uebersicht.html has a similar structure except that the application domain is here Media- and Business Communications. The Informatics courses are equivalent, however as Reutlingen University prefers tailored courses with a strong coherence and examples from the application field no Informatics course is pooled together.

Recently, the School of Informatics has established a research oriented focus for the Master's programme (MRes) in order to strengthen the cooperation with the UWS for a joint doctorate degree Fritz Laux, Alfred Zimmermann, Eckhard Ammann, Forschungsmaster in Wirtschaftsinformatik (MRes in Business Informatics, Fakultät Informatik (School of Informatics), Hochschule Reutlingen (Reutlingen University), 2010.

1.7 University of the West of Scotland ICT curricula

The School of Computing is one of seven Schools in the University and responsible for the Informatics related study programmes. It delivers a wide range of undergraduate and postgraduate programmes N.N. Courses, School of Computing, University of the West of Scotland, URL: http://www.uws.ac.uk/schoolsdepts/computing/courses.asp (08.03.2010) including:

- computing science
- software engineering
- multimedia technology
- computer games technology/computer games development
- animation
- music technology
- computer networking
- web development
- information technology (IT)
- business technology

The studies are organized in courses where the following are related to the DBTech Pro framework:

- Computing (undergraduate)
- Business Technology (undergraduate)
- Information Technology (under- and postgraduate)
- Management of e-Business (postgraduate)
- Multimedia Technology (undergraduate)
- Web Development (undergraduate)
- Networking (undergraduate)

As example we take the Information Technology in the postgraduate studies. The programme offers a mix of core and option modules. The core modules of

the first trimester cover databases and networks for business organisations, object-oriented analysis and design methods for modern IT systems development. In the second trimester each student can choose either technically-oriented or business-oriented subjects as their area of specialism. In the technically-oriented case teaching includes Oracle Database Application Development or Web Technology Development. The business-oriented track deals with e-Business and Mobile Business, Management and Project Management.

Students complete with their Masters dissertation either while working in industry or working in one of the school's research groups.

1.8 University of Málaga ICT curricula

The school Técnica Superior de Ingeniería Informática is responsible for the study programmes Informatics Engineer, Information Management (Ing. Técn. Inf. de Gestión), and

Computer Systems (Ing. Técn. Inf. de Sistemas) N.N. Formulario de Solicitud para la Verificación de Títulos Oficiales de Grado, Vicerrectorado de Ordenación Académica, Universidad de Málaga at the University of Málaga. The duration for the study programmes is eight semesters. The programmes are highly modular and reused in the above degree programmes. Common to all computer engineering studies is for example the module Basic Studies (Formación Básica) that covers among others discrete mathematics, data structures, and data bases. The study structure in total consists of basic studies, compulsory and facultative studies including optional external studies, external practise, and a thesis. Modules are the constituents of the compulsory and facultative studies.

As example, we take the Information Systems module that consists of the following topics:

- Seguridad de la Información Administración de Bases de Datos
- Procesadores de Lenguajes Sistemas Inteligentes II
- Introd. a los Sistemas de Información Sistemas de Información en Internet
- Sist. de Información Empresariales Análisis y Diseño de Sist. de Informac.
- Dis. y Explot. de Almacenes de Datos
- Dirección de Proyectos de S.I.
- Administración de Redes y Sistemas
- Negocio Electrónico

This module is offered over two semesters. It is mentioned in N.N. Formulario de Solicitud para la Verificación de Títulos Oficiales de Grado, Vicerrectorado de Ordenación Académica, Universidad de Málaga that the school of Técnica Superior de Ingeniería Informática follows the ACM recommendations in their curriculum, but it is simply impossible to implement it to the same degree as described in Barry M. Lunt (Chair), Joseph J. Ekstrom, Sandra Gorka, Gregory Hislop, Reza Kamali, Eydie Lawson, Richard LeBlanc, Jacob Miller, Han Reichgelt. Information Technology, Curriculum Guidelines for Undergraduate Degree Programs in Information Technology, Association for Computing Machinery (ACM), IEEE Computer Society, 2008 given the 8 semester time constraint.

1.9 University of Macedonia (Thessaloniki)

The Department of Applied Informatics of the University of Macedonia offers an 8-semester Bachelor's degree in Applied Informatics and a 4-semester Master's degree in Applied Informatics.

In the undergraduate curriculum, there are four courses that are relevant for the DBTech framework:

1. Databases I (core course - 5th semester, database design, SQL)
2. Databases II (core course - 6th semester, internals of the DBMS)
3. Web Programming (core course - 8th semester, with emphasis on database connectivity and transactions on the J2EE framework)
4. Advanced Topics in Databases (elective course - 6th semester, XML databases, Semantic Web, Data Mining, ORDBMS)

In the graduate curriculum, there are two study programs, namely, “Business Informatics” and “Computer Systems”. Both programs offer a common core course under the title “Database Technology” that covers material from the above mentioned undergraduate courses 1, 2 and 4. The “Computer Systems” study program offers an elective course under the title “Knowledge Discovery from Databases”, where we extensively use the DBTech lab material.

2. Analysis of sample curricula with regard to data and information management

In the previous DBTech Pro project we have developed a framework of courses for data and information management professional (see: 1.1 DBTech Pro Framework on page 2). This framework has been developed further in order to reflect the latest developments in database technologies.

The implementations at partner institutions and at professional, non-profit organisation have been compared with the DBTech reference curriculum. We found the following:

2.1 Commonalities

It is the purpose of all reference and model curricula to be as flexible as possible in order to receive wide acceptance. Even, CC2001 attempts to balance conflicting aims of flexibility versus ease of implementation (see Anne Cable et. al. Anne Cable, Ernest Carey, Peter Isaacson, Patricia Tucker. Implementing Computing Curricula 2001 (Panel Discussion), Journal of Computing Sciences in Colleges (JCSC) 17, 1 (October 2001)).

All investigated curricula agree widely in the basic knowledge of data management, namely the "Principles of Database Systems" on introductory level:

- Concepts of Database Systems and Environments
- User roles
- Ansi/Sparc Architecture
- Conceptual models: ER and UML
- Data Modelling
  - Relational Model (RM)
    - Hierarchical (for XML)
    - Network Model (for ODBMS)"
- Relational Theory, Relational Algebra
- Normalization
- Object-oriented Model
- ODMG Standard
- SQL Basics
- QBE
- Security
- Transaction Principle, Concurrency Management, and Recovery
- Performance
- Overview of Standards
- Client-Server model

- Introduction to database design, database programming, and database management

In "DBMS Technologies", at intermediate level, the content is as well homogenous and has been settled. The topics covered are:

- SQL DDL and DML
- Mapping conceptual schema to a relational schema
- Data integrity
- Security Control
- System Catalogue
- File organizations, data structures, indexing principles
- Indexing technologies
- Query Processing and Optimization
- Transaction Management
- Concurrency Conflicts and Control
- Backup and Recovery Techniques
- Object-Relational concepts
- Performance Tuning
- Distribution and Replication
- Introduction to advanced topics

With the exception of Performance Tuning all investigated ICT curricula address the above topics.

2.2 Differences

Taking the DBTech Pro framework as reference we have to state that neither the ACM or European non-profit organizations fully cover all topics. This is clearly unlikely for several reasons: lecturers' competence, time constraints for the study programme, different opinions on trends, and importance of emerging research topics.

This applies to the advanced themes marked as “elective” in the DBTech framework. These are:

- Data Access Technologies
- Database Design Methodologies
- DBMS Administration
- Data Warehousing
- Data Mining
- Advanced Topics (specialized databases: e.g. medical, active, multimedia, real-time, fault-tolerant, embedded, mobile, temporal, and deductive/ontological databases)

Depending on the research groups these advanced topics are partially addressed by the DBTech partners. The A.T.E.I. and the University of Macedonia (UoM) are experts in OLAP, Data Warehousing, and Data Mining, Haaga-Helia has high competency in Data Access Technologies and DBMS Administration, UMA researches on Deductive Databases and Ontologies. The UWS has its strength in Database Design Methodologies, and Reutlingen University works on Mobile Databases, Business Intelligence, and Enterprise Knowledge Models.

2.3 Comparison Table

The comparison was conducted in multiple dimensions, regarding the knowledge domain and cognitive level according to Bloom’s taxonomy and using the structure of the DBTech framework. The results are summarised in Table .

Microsoft Excel - FrameworkV14.xls [Kompatibilitätsmodus]

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**DBTEch Pro Framework**												
2	Version 1.3 (13.12.2010)					British Computer Society (BCS) Professic							
3	**DBTech Pro Framework Reference courses and Topics**	Roles and target level of skills (Bloom's taxonomy)	**IEEE/ACM CC2008**	**EUCIP initiative of CEPES**	**ACM IS 2010 Curriculum Update**	**BCS Professional Examination 2003**	**IEEE SweBOK**	**Haaga-Helia**	**ATEI Thessaloniki**	**Univ. Málaga**	**Reutl. Univ.**	**UWS, Paisley**	**Univ. Macedonia**
4		http://www.edpsycinte	ter.org/portal/web/	http://www.euc	m.org/educati	http://www.bcs.org/ser	http://www.co						
5	**Principles of Database Systems** (Level: Introduction, - obligatory)	**"EUCIP core IM knowledge"**	CS2:IM1, IM2	EUCIP core IM knowledge		BCS Diploma (D) - Database Systems	CS 5 IM	covered	covered	covered	covered	covered	covered
6													
7		"Start level" of DBTech Pro											
8	**DBMS Technologies** (Level: Intermediate, - obligatory)	**DBTech Pro basic knowledge**	CS2:IM2, IM4, IM5			BCS Diploma (D) - Database Systems		covered	covered	covered	covered	covered	covered
9													
10	The Elective Courses of DBTech Pro												
11	**(P) Data Access Technologies** (Level: Advanced, - Elective)	**Database Access by Software developers**	CS2:IM5, IM7, IM8, CS372			BCS Professional Graduate Diploma - Advanced DBMSs	SWEBOK Software Design	covered	partially	partially	partially	partially	partially
12													
13	**(D) Database Design (Methodologies)** (Level: Advanced, - Elective)	**DB Analyst/ Designer, DB specialist**	CS2:IM4, IM6, CS371			BCS Professional Graduate Diploma - Advanced DBMSs		partially	partially	partially	partially	partially	partially
14													
15	**(A) DBMS Administration** (Level: Advanced, - Elective)	**DBA, DB specialist**	CS2: IM8, IM9, (IM11) CS370, CS373/DDBMS			BCS Professional Graduate Diploma - Advanced DBMSs		covered	not covered	not covered	not covered	not covered	not covered
16													
17	**(W) Data Warehousing** (Level: Advanced, - Elective)	**DB Decision Support (DS) Specialist**	CS374					partially	partially	partially	covered (Master)	partially	partially
18													
19	**(M) Data Mining** (Level: Advanced, - Elective)	**Discovery in DBMSs (KDDS) Specialist**	CS2:IM10, CS375					partially	partially	partially	covered (Master)	partially	partially
20													
21	**Advanced Topics** (Level: Intermediate/Advanced, - Elective)	**to be aware of by DB professionals**	CS370, CS373			BCS Professional Graduate Diploma - Advanced DBMSs		partially	partially	partially	partially	partially	partially
22													

Mappings / Courses and Topics / BloomTaxonomy / Sheet3

Table : Comparison of ICT curricula recommendation compared to DBTech Pro framework[1]

3. Adaption of DBTech Pro Framework of courses at the partner institutions

There are obviously many ICT model curricula and frameworks. It seems that designing a reference curriculum at the "green table" is an easy task for the experts as they only need to name topics and bring them in a meaningful structure. The implementation is much more difficult as it has to deal with political and economical constraints, and finally with the

1 Updated version of Dimitris A. Dervos. WP4: Content Planning. DBTech Pro Project, WP4 Final Report, 2004, DBTech Pro FIN-02-B-F-PP-126706

available lecturers. This reality has lead to vivid discussions Jo Tondeur, Johan van Braak, Martin Valcke. Curricula and the use of ICT in education: Two worlds apart. British Journal of Education Technology (2006).Joke Voogt, Hans Pelgrum. ICT and Curriculum Change. Human Technology, Volume 1 (2), October 2005, 157-175, ISSN: 1795-6889Russell Shackelford, Andrew McGettrick, Robert Sloan, Heikki Topi, Gordon Davies, Reza Kamali, James Cross, John Impagliazzo, Richard LeBlanc, Barry Lunt. Computing Curricula 2005: The Overview ReportGlenn Finger, Romina Jamieson-Proctor, Glenice Watson. Recommendations for the Development of an ICT Curriculum Integration Performance Measurement Instrument: Focusing on Student Use of ICTs. Griffith University, Australia, Paper no. FIN03386 (2003). http://www98.griffith.edu.au/dspace/bitstream/10072/1715/1/22229.pdf and academic publications Eric Roberts, C. Fay Cover, Gordon Davies, Michael Schneider, Robert Sloan.Computing Curricula 2001 - Implementing the Recommendations, SIGCSE'02, February 27- March 3, 2002Anne Cable, Ernest Carey, Peter Isaacson, Patricia Tucker. Implementing Computing Curricula 2001 (Panel Discussion), Journal of Computing Sciences in Colleges (JCSC) 17, 1 (October 2001) on the implementation of computer science curricula. Another complicating factor is the dynamics in research and technological development. At present (March 2010) ACM has already an updated draft version for the Information Systems (IS2010) Heikki Topi, Joseph S. Valacich, Ryan T. Wright, Kate Kaiser, J.F. Nunamaker, Jr., Janice C. Sipior, GJ de Vreede. IS 2010 - Curriculum Guidelines for Undergraduate Degree Programs in Information Systems Association for Computing Machinery (ACM), Association for Information Systems (AIS) curriculum.

It seems that there is no easy way to adopt foreign ideas under severe constraints. The situation for the DBTech academic partners is more favourable as we developed small modules of different knowledge levels, the authors are available for adaption, and all partners have been involved in the development.
The DBTech partners use intensively the workshop material elaborated during DBTech Pro and DBTech EXT projects. This ensures the content adaption to a high degree. At Reutlingen University and at Haaga-Helia the books of DBTech member professor Thomas Connolly have been adopted as text book. The partners regularly organise intensive workshops on Business Intelligence and Data Mining where the DBTech authors present their material. The DBTech Business Intelligence and Knowledge Discovery from Databases (BI&KDD) workshop has been fully integrated into the regular course curricula (both at the

undergraduate and MSc degree levels) of ATEI and the University of Macedonia, since the Spring semester of the 2008-2009 academic year.

However, the harmonisation process of the European higher education (Bologna Process) seems to have divergent effects in the member countries. In Germany this process lead to highly structured study programmes with very little flexibility. The purpose to enable mobility and transparency in the European education area completely failed in Germany as there is no more time to cover the overhead introduced by language barriers, different culture and educational systems which would be necessary preconditions. In fact, students have to spend additional semesters if they want to experience the study in a foreign country. Students coming to Reutlingen sometimes seem to be sent because of Erasmus mobility allows to cut down the resources at their home university and force the students to get the credits elsewhere. If the process of harmonisation continues this way we end up in Europe loosing the diversity of education cultures and standardise the quality of education to a mediocre level.
The middle-rate education level will give universities the chance to strengthen their own profile again ignoring the European guidelines and specifications.

References

[1] Dimitris A. Dervos. *WP4: Content Planning*. DBTech Pro Project, WP4 Final Report, 2004, DBTech Pro FIN-02-B-F-PP-126706

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[4] *Computer Engineering 2004 - Curriculum Guidelines for Undergraduate Degree Programs in Computer Engineering*, A Report in the Computing Curricula Series, Joint Task Force on Computer Engineering Curricula, IEEE Computer Society, Association for Computing Machinery, 2004 December 12

[5] Barry M. Lunt (Chair), Joseph J. Ekstrom, Sandra Gorka, Gregory Hislop, Reza Kamali, Eydie Lawson, Richard LeBlanc, Jacob Miller, Han Reichgelt. *Information Technology, Curriculum Guidelines for Undergraduate Degree Programs in Information Technology*, Association for Computing Machinery (ACM), IEEE Computer Society, 2008

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