Handling Heterogeneous Academic Curricula

Richard Hackelbusch

Carl von Ossietzky Universität Oldenburg
D-26121 Oldenburg, Germany
hackelbusch@uni-oldenburg.de
• Motivation and Problems
• Modularization and Current Situation
• Requirements
• Concept
• Related Work
• Conclusion
Motivation and Problems

• Academic programs follow very heterogeneous curricula
  – Different types of courses and classes
  – Different naming and workloads of courses and classes
  – Comparing of academic programs and curricula is difficult
• Comparability of academic programs (and courses) is a challenge
  – EU and European States want to support the students’ (international) mobility
  – Increase possibilities of using distance learning using information and communications technology (ICT)
  – Allow the transfer of distance learning courses between academic institutions (e.g., “eLearning”-courses)
• Question: Which courses of other academic institutions can be alternatively used in order to satisfy the program requirements?
Bologna-Process

• Aims
  – Making university degrees European-wide comparable
  – Increase students’ mobility

• Timeline
  – Introduced on June 19, 1999
  – Reforming of academic programs and curricula up to the year 2010

• Reforms
  – Applying a two-stage modularized system with Bachelor- and Master
    degrees and a system of credits like ECTS
  – Recording of finely-granular indication of students’ achievements
    (“Diploma Supplement”); study-accompanying examinations

• Implementation can improve the possibilities of a university change
  while continuing the academic program
• Regulated by the Framework Act for Higher Education ("Hochschulrahmengesetz", HRG)

• Replacing old academic programs with Diploma- or Magister degrees by new two-stage system with Bachelor- and Master degrees including modularization

• Problems
  – Existing academic programs often are simply slightly adapted
  – Dividing of old programs into two “new” programs, based upon each other
  – Often, only a required minimum of the guidelines are implemented
  – Academic programs still follow heterogeneous curricula
Modularization

- Modularization: Aggregation of academic courses/classes into thematically and temporally rounded off self-contained units
- Each unit is called a **module**
  - Each module can be made up of different types of lessons
  - In principle, each taken module can only be passed by passing an examination
  - A successfully passed module qualifies to acquire **credits**
- **Credits**
  - Measure describing the student’s workload
  - Measure includes the workload of the direct tuition and examination (including preparation and follow-up)
• **Aim:** Simplifying and improving the possibility to transfer credits between academic institutions

• **Criteria to transfer credits:**
  – Modules can be used as substitutions
  – Two modules are equivalent if they correspond in content, amount and requirements essentially

• **Modules must be described in a certain schema (“module descriptor”):**
  – Contents and qualifications aims
  – Teaching and learning methods
  – Prerequisites for participation
  – Usability
  – Credits/Workload, Duration
  – Frequency of the offer
Current Situation

• The “new” modularized academic programs turn out very heterogeneous, too – although guidelines are fulfilled
• The problem how to find applicable modules of other academic institutions still remains existing
  – Students must identify them by themselves
• Transferring credits is a complex process
  – Identifying an applicable module
  – Enrolling as cross-registered student at corresponding institution – month before the start of the term
  – Passing the module/examination
  – Filing an application to transfer the acquired credits
• ICTs to support students within this process are missing
Requirements

• Identify modules of other academic institutions as
  – Interchangeable, organisatorical and semantical equivalent to modules of
    the primary campus-based institution

• Adapt to the students’ individual study progress
  – List only modules which the corresponding student can take

• Integration into existing LMS
  – Handling of external modules the same way like “normal” modules
  – Usable by students and lecturers

• Data has to be made available solely to necessary extend and, as
  possible, not in addition
  – Protection of personal data
  – Exclusive control over supply of course materials (copyright, accounting)
Approach

• Two areas to cover
  – Identifying which modules of their primary institution can be taken by students in general and as a 2nd step identify possible substitutes or applicable modules of other academic institutions
  – Designing a framework architecture to connect several LMS to support those services

• Identifying modules
  – Curricula Mapping Ontology (CMO) to identify modules which can be taken by students
  – Using case based reasoning (CBR) techniques in conjunction with CMO as basis to find substitutes

• Framework application
  – Using Peer-to-Peer (p2p) techniques to connect academic institutions and their LMS
Ontological Representation of Examination Regulations

- Representing **examination regulations** with ontological concepts
  - Examination Regulations form the statutory framework of academic programs
- Using a process view

- A simple example of such a process

[Diagram showing a process with various obligations and selections leading to a Bachelor-Degree]

Motivation and Problems • Modularization and Current Situation • Requirements and Concept • Related Work • Conclusion
Curricula Mapping Ontology

- Curricula Mapping Ontology (CMO) used as meta model
- Supply of concepts to model examination regulations and academic modules
Identifying possible substitutes

• Identifying external equivalent modules / modules that can be integrated into a specific curriculum using case based reasoning techniques (especially case retrieval nets, CRN [Lenz/Burkhard 1996])
  – CRN allow the determination of similarity between cases using a propagation function on a net of so called information entities
  – Comparison of modules using values of the module descriptors and CRNs
  – Using knowledge from the past
  – Which modules/module types can a student take of his own campus-based institution?

• Ascertaining if those external modules that could be integrated into a specific curriculum can be taken at external academic institution
  – Are all requirements satisfied to be able to take that module?
Comparison on content level

• Comparing on the level of the subject matter is usually indispensable
  – Two Modules with equal names do not have contain the same subject matters
  – Two Modules that can be taken in equal parts of curricula of different academic programs do not have to contain the same subject matter, too

• Including additional information extracted from the corresponding module descriptors

• Challenge: Comparing subject matters by analyzing contents and qualification aims as described in the module descriptors
  – Possible Techniques: Lemmatization/Stemming, Text Indexing, Ontologies
• Most useful architecture does not only depend on functional requirements
  – Supply and integration of modules concern autonomous partners
  – Implementation of a centralized architecture would be very difficult
• Suggestion: Implementing a distributed architecture using p2p techniques
  – Architecture has the same structure as the given problem
  – Minimum of personal data must be transferred
  – Each institution keeps full control over offered course materials
  – Test if an external module can be integrated can be done at the peer of the student’s primary university
  – Each institution can integrate their own LMS (e.g., using Web-Services)
• Overview of the suggested architecture

LMS A

university X

offered modules

Web Services

CMO

CRN

offered modules, course materials, exercises, grades

module choices, homework

student

lecturer

offered modules, course materials, exercises, grades

homework

LMS B

university Y

offered modules

Web Services

CMO

CRN

curricula, module descriptions

course materials, exercises, homework, grades

Web Services

p2p

...
Status and Future Prospects

• Nearly Finished:
  – CMO as ontological meta model to represent examination regulations and curricula

• Development phase:
  – Decision Support System to support students in planning their individual curriculum and to support lecturers in planning their supply
  – Module Comparison System to allow comparisons of modules (descriptors)

• Design phase:
  – Distributed framework to couple Decision Support System, Module Comparison System and several Learning Management Systems of different academic institutions
Related Work

• Representation of examination regulations – planning of individual curricula

• Ontological representation of legal information
  – McCarty (1989): Language for Legal Discourse

• Supply of virtual learning content
  – ELAN: eLearning Academic Network Niedersachsen
  – VHB: Virtual University of Bavaria

• Description of Learning Materials
  – LOM, SCORM
**Conclusion**

- Implementation of presented concepts can bring advantages for all participating actors

- **Students**
  - Can choose from a wider range of available modules; not bound to supply of their primary institutions
  - Can choose the most valuable modules
  - Impose pressure upon their primary institutions to offer modules of a high quality and usage

- **Lecturers and Academic Institutions**
  - Potential demand for modules will increase
  - Able to acquire funds by using billing and bonification systems to supply modules to students of other institutions
  - On the long term, a further specialization of institutions is imaginable