Tempus Project: QANTUS

BOKU Experiences with Implementation of Bologna Process
Part I

Willibald Loiskandl
Content

Introduction on University structure
Historical development
BOKU- experience
  From “Diplomingenieur” to Bachelor / MSc
  Environmental Engineering
Review and improvement of bachelor structure
Structure of “BOKU”

Founded 1872
1000 Scientists
50% third party founded
1550 total personal
12,500 Students
Structure of University Organisation - BOKU

- Organization of study programmes and courses
- Information for secondary school graduates
- Administration of the study program
- Administration of student records and certificates
- Continuous professional development
- Support of alumni
- Teaching methods
- Quality assurance, Evaluation
- E-learning

Centre for Education
Structure of University Organisation - BOKU

• International office
  ➔ platform for international activities
  ➔ transmit information among different partner institutions, but also internally

• Establishment of quality assurance groups

• Strategy for the Internationalisation of BOKU

From the BOKU Mission Statement:
The BOKU professes to being an international performer in research and teaching, cooperating across national and international borders, and initiating open-mindedness towards new developments
Introduction BOKU – Study Programmes

**Bachelor studies** (time-line: 6 semesters)

1st Degree: “Bachelor of technical sciences”

**Master studies** (time-line: 4 semesters)

a continuing program after the bachelor study 2nd Degree:

“Master of engineering”

**PhD studies** (time-line: 6 semesters)

Program which is offered for master program graduates.

Degree: “Doctor of Agricultural Sciences” (Dr. nat. techn.)

NEW: Doctorate of Social and Economic Sciences at BOKU

(Dr.rer.soc.oec)

Further information: www.boku4you.at
Curriculum development at BOKU

Corner stones for education → Bologna declaration
- Comparable and transparent curriculum structure
- European Credit Transfer System (ECTS)
- Political decisions
- New partnerships and co-operations
  - national
  - international
  - global

EU - Programmes
- e.g. TEMPUS support capacity building at higher education institutions
Curriculum development at BOKU

From “Diplom-Ingenieur” to Bachelor / MSc

Frame for Bachelor – Master – System

Total Duration ............ 210 Wh / Sem.  (before ≈ 250 Wh / Sem.)

Bachelor .................. min. 70% @ 147 Wh / Sem.
Master ....................... max. 63 Wh / Sem.
Elective subjects ........... min. 10% @ 15 Wh / Sem.
BOKU experiences with curriculum development

From “Diplomingenieur” to Bachelor / MSc

Frame for Bachelor – Master – System

Total Duration ............ 210 Wh / Sem.

Bachelor ................. min. 70% ≈ 147 Wh / Sem.
Master ..................... max. 63 Wh / Sem
Elective subjects .......... min. 10% ≈ 15 Wh / Sem.
Environmental Engineering

- was introduced in 1883 as a 3 years course for academic instruction on land improvement and reclamation (drainage, irrigation).

  The field of activity was the rural (agricultural) area.

- is an applied technical orientated course with strong background on natural sciences and ecological empathy. This allows graduates to work at an interdisciplinary level in planning, implementing, supervising, maintaining and administrating engineering projects related to land and water management as well as waste disposal.

  The field of activity is still the rural area but in close interrelation with the demands and special features of the urban area.
BOKU – First steps to modularisation

Before 1996

- Part I: 62 compulsory courses
- Part II: 179 compulsory courses, 15 elective specialisation courses

Study reform 1996

1996 - 2003

- Part I: 54 compulsory courses
- Part II: 156 compulsory courses, 40 elective specialisation courses (5 blocks à 8 h), 21 elective courses, 5 thesis seminar

Total Duration: 256 Wh / Sem. ~ 6%

Total Duration: 210 Wh / Sem. = 300 ECTS

~ 30%
### Study reform 2003

#### Diploma Curriculum

**Pros**
- Well known, accepted
- Balanced curriculum
- Distinct to curricula of competitors
- Broad range of professional topics
- Problem oriented approach

**Contras**
- Limited compatibility with international programmes
- Lack of international recognition
- No graduation for drop out candidates
- Long study duration

#### Bachelor - Master

**Pros**
- Internat. Acceptance
- Comparable formal standards
- Stimulation of mobility
- Competitive to FH Bachelor graduation

**Contras**
- Difficult a priori evaluation
- Unknown employers acceptance of Bachelor degree
- Non homogeneous Master programs
- Broad range of professional fields only with B+M
Strategic approach

Starting point:
- Evaluation of development potential for new curricula
- Analyses of internal and external factors of education environment

- Mission statement: BOKU advocates for research-oriented education and learning (The university takes part in generating the research topics which are reflected in education)
Strategic approach, education environment

- Strategic orientation of BOKU (areas of competences)
- Assessment of existing study programmes
- Requests from society
- Scientific development
- Employment requirements

User demands
- Expectations
  - Graduates
  - Employers
- Market conformity
  - Research
  - Education

Research
- Quality assessment
- Needs for improvement
- Adequate training facilities
- New means of teaching
- etc.
Strategic approach, education environment

Challenges of university education

- Theory vs. practice orientation
- Education vs. training (Employability)
- Academic Quality vs. Employability
- Study as education experience vs. Employability
- Research- vs. education scopes
- Academic liberty vs. societal responsibilities
- Tradition vs. Innovation
- Nationality vs. Internationality
- Disciplinary vs. Interdisciplinary
PROJECT – “BOKU studies in the future"
http://www.boku.ac.at/projekt.html
Strategic approach

Starting point:
• Evaluation of development potential for new curricula
• Analyses of internal and external factors of education environment

• Mission statement: BOKU advocates for research oriented education and learning (*The university takes part in generating the research topics which are reflected in education*)
Strategic development of study curricula for a time horizon 2010 – 2015

• Development of new curricula
• Improvement of existing curricula

Existing programmes:

9 Bachelor – Studies
29 Master – Studies

11 in English
6 joint programmes
Consequences – study programmes

B = Basics
Ss = Soft skills
Cs = Curricula specific
As = Advanced specialisation
Preparatory works

to obtain principles for strategic orientation of BOKU-Studies

based on content criterias

- Natural science
- Engineering science
- Socio-economic science

based on structural criterias

- Qualification profile
- Structure
- Type of lectures
- Compulsory and elective lectures
- etc.

Guidelines for concept of BOKU-Studies – working groups

- Study goals and content
- Structure and model
- Degrees
- Mobility
- Internationalisation
- Teaching- und learning methods
Agreed - principles

3-column model: Identity und Characteristic of BOKU-Studies

**Bachelor:**
à 25% NASc, Technique, Socioeconomic

**Master:**
à 15% NASc, Technique, Socioeconomic
Agreed - principles

Bachelor programme
  • Science- and general basic oriented
  • Conception oriented on BOKU-Master studies
  • Job oriented and empowered

High flexibility (mobility)
  continuation from one bachelor to different master

Modularisation
  Creation of bigger lecture units

Degrees
Master: According to orientation: Master (Magister) or Dipl. Ing
Modularisation

Module:
closed, formal structured learning process (according to Bologna declaration)
  • thematic defined learning and teaching
  • with defined, coherent learning outcomes
  • defined workload of students (ECTS-Credits)
  • unambiguous and transparent grading criterias
Agreed – principles, Mobility

External Bachelor

BOKU-Bachelor

Continuing same study direction

All BOKU-Bachelor

Master programmes
Agreed – principles, interchangeability

External Bachelor

BOKU-Bachelor

Master programmes

Continuing same study direction

All BOKU-Bachelor
Modularised curriculum concept

Bachelor

<table>
<thead>
<tr>
<th>6 Semester 180 ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective lectures 15 ECTS</td>
</tr>
<tr>
<td>Elect. specialisation 15 ECTS</td>
</tr>
<tr>
<td>Master specific</td>
</tr>
<tr>
<td>Compulsory lectures</td>
</tr>
</tbody>
</table>

Master

<table>
<thead>
<tr>
<th>4 Semester 120 ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective lectures 6 ECTS</td>
</tr>
<tr>
<td>M3</td>
</tr>
</tbody>
</table>
3 Columns of Education
Identity and Characteristic of BOKU-Studies

Bachelor:
à 25% Natural Sciences, Technique, Socioeconomic

Master:
à 15% Natural Sciences, Technique, Socioeconomic
BOKU master programmes in English 2014

- Water Management and Environment Engineering (WMEE introduced 2011)
- Mountain Risk Engineering
  (merged with WMEE academic year 2011)
- International Master of Natural Resources Management and Ecological Engineering (NARME)
- Environmental Sciences – Soil, Water and Biodiversity
- Limnology and Wetland Management
BOKU master programmes in English 2014

- Master Mountain Forestry
- Master Sustainability in Agriculture, Food Production and Food Technology in the Danube Region
- Master Safety in the food chain
- Master DDP Msc European Forestry
- Master DDP European Master in Animal Breeding and Genetics (EM-ABG)
- Master Organic Agriculture Systems and Agro-ecology (EUR-Organic)
- Master Horticultural Sciences
Global Partnership
Two universities — one in the northern and one in the southern hemisphere — have joined forces to produce an innovative Masters degree.

Why this degree?
In a world of increasing internationalisation, individual nations are increasingly extending and inter-penetrating their environmental impacts and 'ecological footprints ...............

What is it?
The 'Master of Natural Resources Management and Ecological Engineering' (NARMEE) is a two-year Masters combining both examination and thesis. Students are required to study at both places, and will finish with a jointly-awarded degree.

Spellerberg I.F., Loiskandl W., Buchan G. (2007): A joint, international masters degree in sustainability: how a truly global programme was established. Environment, Development and Sustainability, 6 (1), 67-80; ISSN 1387-585X
Each university has three fields of specialisation, requiring that the university offer ASPs within each of these.
Student mobility

Student exchange requires European Credit Transfer System - ECTS

Credits represent workload
Credits not to be confused with grades

ELLs - Conference
Internationalisation and Quality Assurance
Working Groups:
Joint curricula: challenges for the institutions and for students
Facilitating student mobility
Life Long Learning LLL Austria

Legal Framework

LLL: 2020 - Strategy for Life Long Learning Austria

• 4 Basic Principles
• 5 Strategic Guidelines
• 8 Key Competences

Publishers
– Ministry of Education, Arts and Culture
– Ministry of Science and Technology
– Ministry of Labour and Social Affaires
– Ministry of Economy, Family and Youth

Life Long Learning (LLL) Austria

4 Basic Principles
- Gender and Diversity
- Equal Chances and Social Mobility
- Quality and Sustainability
- Performance and Innovation

5 Strategic Guidelines
- Life Phase orientation
- Apprentice is the centre
- Life Long Guidance
- Competence orientation
- Participation support

8 Key Competences
- Competence in mother tongue
- Competence in foreign languages
- Competence in Mathematics and Natural Sciences
- Competence with Computer
- Learning Competence
- Competence in interpersonal, intercultural and social interaction
- Enterprise Competence
- Cultural Competence

BOKU Life Long Learning

BOKU Implementation Procedure

• Departments suggest LLL-Activity
• Senate develops Quality Assurance
• Office of Rector approves LLL-Activity

BOKU Implementation Guidelines

• Self-financing
• Provision of professional and work-related extra qualifications
• Relevant to society
• Belonging to one of four categories \textit{(cf. next slide)}
BOKU Life Long Learning

Category I:
- 90 ECTS
- Finally certified:
  Master of ...
  (e.g. Business Administration)

Category II:
- 60 ECTS
- Academically certified ...
  (e.g. Academic Estate Manager)

Category III:
- < 60 ECTS
- Summer Schools, Seminars
- With course assessment

Category IV:
- < 60 ECTS
- Summer Schools, Seminars
- With certificate of attendance
- Without course assessment

Source: http://www.boku.ac.at/17543.html
BOKU Life Long Learning

Category I: (3 Courses)
• MBA in Sustainable Development and Management
• MBA in Environmental Management
• MEng NanoBiosciences & NanoMedicine

Category II: (3 Courses)
• Academic hunter
• Academic Course: Media naturae
• ULG Ländliches Liegenschaftsmanagement

Category III:
• Summer schools – Euroleague – EU e-learning

Category IV:
• Univ.-Kurs Bleichen in der Papierrestaurierung

Source: http://www.boku.ac.at/17542.html
Department of Water, Atmosphere and Environment
Institute of Hydraulics and Rural Water Management

Department für Wasser – Atmosphäre – Umwelt
Institut für Hydraulik und landeskulturelle Wasserwirtschaft

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http://www.boku.ac.at/projekt.html
BOKU Experiences with Implementation of Bologna Process
Part II

Willibald Loiskandl
3 – level education

Bachelor – Master – PHD System

Corner stones for education → Bologna declaration

- Comparable and transparent curriculum structure
- European Credit Transfer System (ECTS)
- Political decisions
- New partnerships and co-operations
  - national
    - international
    - global

EU - Programmes

e.g. TEMPUS  support capacity building at higher education institutions
Prerequisites for comparison

Credits represent **workload**
Credits **not** to be confused with **grades**

**Additional**

- ETCS is the **European Credit Transfer System**
- ETCS is a tool for **harmonisation** — not homogenisation
- ETCS is a programme from **SOCRATES**
- ETCS serves the **mobility** in Europe
Characteristic that make ECTS work

- Transparency
  - Information Package
  - Transcript of Records
- Agreement
  - Learning Agreement
  - Programme of Study Agreement
- Credits
  - One academic year = 60 Credits
European dimension, Student mobility

How to encourage students?

- Mobility grants
- Full recognition of work done abroad
- Full implementation of ECTS
- Local job market acceptance
- Work abroad
- Language skills
- Participation in courses taught in a foreign language (technical) required
- Information, Dissemination, Marketing
Present Bachelor Curricula

Summary: Bachelor programme structure  BOKU 2006

• Admission: issued by rector (vice rector of education)
• 6 Semester

• Compulsory courses  148 ECTS
• Bachelor Thesis (Interdisciplinary Work)  12 ECTS
• Free elective courses  15 ECTS
• Compulsory Practical training 5 weeks  5 ECTS
• Total  180 ECTS

• BOKU (1 Bachelor programmes Environmental Engineering)

BOKU homepage http://www.boku.ac.at/1902.html
Present Master Curricula

Summary: Master programme of BOKU 2006

• Admission: issued by rector (vice rector of education)

• **4 Semester**
  - Compulsory courses 20 ECTS
  - Elective courses 64 ECTS
  - Free elective courses 6 ECTS
  - Master thesis 30 ECTS
  - Total 120 ECTS

• Compulsory Practical training 4 weeks

• BOKU (2 master programmes Environmental Engineering and Water & Environment Related international programmes NARMEE and EnvEuro)

BOKU homepage http://www.boku.ac.at/1903.html
Bachelor and Master Programmes at BOKU related to the IHLW

- Environmental Engineering
- Environmental Engineering (KTWW in German)
- NARMEE (in Engl.)
- Water Management and Environmental Engineering (in Engl.)
- International Course in Environmental Management and Ecological Engineering – ENVEURO (in Engl.)

3 Pillars of Education

Identity and Characteristic of BOKU-Studies

**Bachelor:**
à 25% Natural Sciences, Technique, Socioeconomic

**Master:**
à 15% Natural Sciences, Technique, Socioeconomic
Qualification - Curriculum of Master degree at BOKU

The Master degree programme in Environmental Engineering allows students to consolidate their knowledge of the areas and working practices within the applied sciences and their engineering-related applications.

This degree programme aims to enable mankind’s use of natural resources.

For this professional training, a good basic scientific knowledge is required, in addition to a comprehensive understanding of the sustainable use of resources and a logical mind for responsible planning, design, construction and maintenance.
Water management aims to sustainably use and secure water as a resource. It is therefore caught in an area of tension between economic and ecological aims.

An understanding of the hydrological cycle is the foundation of water management measures. The many functions of the natural potential of water interacting with the soil should be optimally and uncompromisingly used, protected and, as a basic foundation of life, be secured sustainably.

It is becoming even more difficult to provide water in adequate amounts, but also of adequate quality. The consideration of extremely complex ecological connections and interactions is becoming even more important in this respect.
Qualification - Curriculum of Master degree at BOKU

In areas of water and soil, following subjects will be researched and extensively taught:

- hydrology,
- water management planning,
- constructive hydraulic engineering and river management,
- cultural water and groundwater management,
- settlement water management,
- industrial water management and
- water protection,
- hydrobiology and
- water ecology,
- waste management.
Qualification - Curriculum of Master degree at BOKU

Graduates of the Master degree in Water Management are expected to have the necessary knowledge of administration and management to be successful in their work.

The importance of communication, coordination and leadership abilities, without which, successful work (both within a team and as an individual) is not possible, is emphasised during the university course.

Mobility, foreign language acquisition and internationality are increasingly important qualification criteria for graduates of the Master degree in Environmental Engineering, and are therefore specifically promoted through the three-tier education system (which corresponds to international norms).
Admission - Curriculum of Master degree at BOKU

Graduates of the Bachelor degree in Environmental Engineering from the University of Natural Resources and Life Sciences, Vienna, will be admitted to the Master degree programme.

Graduates of other Bachelor degrees who wish to take the Master degree in Environmental Engineering must be able to demonstrate a fundamental, equivalent knowledge of the central subjects taught as part of the Bachelor degree in Environmental Engineering.

Specifically, this concerns the subjects taught as part of the Bachelor degree in Environmental Engineering in the areas of scientific basics, the technical and subject-specific foundations, the social, economic and legal courses, and the vocational compulsory modules (central to civil engineering)
Summary: Doctoral programme of BOKU 2006

- Admission: issued by rector (vice rector of education)
- **6 Semester**
- Minimum of 180 ECTS, including at least 20 ECTS doctoral courses and at least 160 ECTS for the dissertation

Registration requirements:
- Doctoral thesis topic
- Name of advisor
- A work schedule approved by the advisor including:
  - **Advisory team**
  - **Time schedule** and **resource plan**
- Proposal for doctoral courses (approved by Dean)
- 20 ECTS examination record;
- **Thesis: 2 Reviewers ≠ Advisor**
  Defence of Thesis (examination board: chair + examiners)
E- Learning BOKU

BOKU learn - MOODLE

MOODLE (Modular Object Oriented Dynamic Learning Environment) is used as e-learning platform at BOKU.

BOKU learn was launched in September 2005.

BOKU e-Learning Centre is an integral part of teaching at BOKU.

BOKU e-Learning Centre is embedded in the Center for Education and interlinked with many other BOKU institutions.

Source: http://www.boku.ac.at/e-learning-leitbild.html?&L=1
E-Learning BOKU

software package for producing Internet-based courses and web sites (Open Source!!!)

BOKU's Moodle based virtual learning environment
Characteristics of good E-Learning

E-learning Environment
- Usability of the e-learning environment
  - Visual usability
  - Content usability
  - Guidance usability
  - Website usability

E-learning Management System (LMS) and Personal Learning Environment (PLE)

Teachers E-learning Competencies
- Basic teacher competencies
  - Professional expertise
  - Social competence
  - Self competence

- Central competencies
  - Motivating students
  - Feedback
  - Diversity management
  - E-moderation
  - The proactive teacher
  - Copyright

E-learning Didactics
- Learning paradigms
  - Cognitivism
  - Behaviourism
  - Constructivism

- Basic planning e-learning course
  - What is going to be?
  - Which type of course is it?
  - Which kind of resources?

- Didactic principles of an e-learning course
  - General goals of the e-learning course
  - Structure of the e-learning course
  - Online activities
  - Grading of online activities

Evaluation of E-Learning
- Quality dimensions and indicators
- Evaluation approaches
# Impact on universities?
## During transition and permanently

**ELLs – Conference: Internationalisation and Quality Assurance**

<table>
<thead>
<tr>
<th>University</th>
<th>Academic staff</th>
<th>Administration</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bologna</td>
<td>Language, New partners, Collaboration, Sharing of teaching material, Expertise exchange, New teaching methods, Changes of thinking, Cultural diversity, Mobility and training, Extra work, incentives</td>
<td>Language, ECTS, Flexibility, Mutual trust, International contracts</td>
<td>Language, Different environment, Broaden mind/ Specialising, Integration, International jobs, Make new friends, Lifelong experience</td>
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<tr>
<td>International offices</td>
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<td>Co-operation vs. Competition</td>
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<td>Market presence</td>
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<td>Increase of competence</td>
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<td>Acknowledge time for changes</td>
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<td>Extra costs?</td>
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<td>Incentives, investment in future</td>
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<tr>
<td>European</td>
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</tbody>
</table>

- **European**
- **European**
- **European**
- **European**
- **European**
- **European**
Life is a dynamic process and as defined by eschatology it is heading in the direction for the better (Teilhard de Jardin)
Specific goals of SP-I Teaching Resources

- Adequate research-oriented teaching resources
- Non-academic community involvement and technology transfer
- European dimension
- Measures for student involvement in research
- Continuing education in the water sector
- New research-based resources
European dimension

Bologna process

Duration of BSc-MSc-PhD

Longer study → liberal and flexible curriculum
Shorter study → stringent time schedules (fixed examination periods, continuation requirements etc.)
Background information of ETNET21 partners

Generic titles of programmes offered by ETNET21 partners

<table>
<thead>
<tr>
<th>Civil engineering</th>
<th>Water resources management</th>
<th>Soil</th>
<th>Environment</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>28</td>
<td>5</td>
<td>10</td>
<td>6</td>
</tr>
</tbody>
</table>

Water and environment related courses show the expertise present within ETNET21.

- At present it is not advised to treat bachelor and MSc-programmes separately
- no recommendations for future development were given.
• Traditional actions as well as computer works are standard
• Virtual laboratories have the biggest development potential
Teaching resources and methods

Student activities

- Main topics related to water sciences
- Skills like data analyses and GIS
Teaching resources and methods

workload of practical work

Average water related practical work = 15 %
Average civil engineering related practical work = 16 %
Teaching resources and methods

Ranking of courses involving practical work

courses including practical work

- Sanitary Engineering
- Hydraulic Laboratory Practice
- Advanced Hydraulics
- Hydrometrics Course
- Soil Mechanics
- Land Survey
- Chemical and Biological Basic Lab.
- Geology
- Botany
- Chemistry
Teaching resources and methods

Kind of field works

courses including fieldwork

- Surveying
- Others
- Hydrometry
- Earth Science (Geology, Soil Science)
- Sanitary Engineering
- Groundwater
Teaching resources and methods

Final thesis is part for all programmes!

Thesis ECTS-Allocation
Teaching resources and methods

Involvement of students into research

- Courses: 38%
- Final project: 47%
- Interaction with staff: 15%