E-Learning in the Context of the European Higher Education Area

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European Higher Education Area
implications for E-Learning
trends and challenges for E-Learning

E-Learning Centre @
Vienna University of Technology
history, activities, services
projects and ideas to meet the challenges posed by EHEA
The European Higher Education Area

Promote Mobility

- „E-Bologna“, Virtual European Higher Education Area
- complement physical mobility with virtual mobility
- support physical mobility with ICT
- “Internationalisation”

Establish Quality Standards

- E-Learning may be able to reduce costs / resources for administration of education
- anyhow, making a low quality course available on the web does not result in a high quality course
- attitude towards quality
  “rise of quality culture” [EUA Report: Trends V]
- effective teaching needs careful educational planning
  → additional efforts, increased costs

Support LifeLong Learning

- (re-)use of learning material in different contexts
- able to reduce high costs for production / creation of such material
- earn money from CE courses
  → need for content-management and for re-use /sharing of existing content
European Higher Education Area

Link to the European Research Area

- STUDENTS AS PARTICIPANTS
  - Research-tutored: Curriculum emphasizes learning focused on students writing and discussing papers or essays.
  - Research-based: Curriculum emphasizes students undertaking inquiry-based learning.

- EMPHASIS ON RESEARCH CONTENT
  - Research-led: Curriculum is structured around teaching subject content.
  - Research-oriented: Curriculum emphasizes teaching processes of knowledge construction in the subject.

- EMPHASIS ON RESEARCH PROCESSES AND PROBLEMS

Jenkins et al. (2007):  http://www.heacademy.ac.uk/assets/York/documents/LinkingTeachingAndResearch_Apr07.pdf

European Framework for Qualifications

- qualifications: knowledge, ability, understanding, ...

Types of Learning:

- “know-that”: factual knowledge
- “know-how”: procedural knowledge
- “can do”: mastery, proficiency

→ requires different educational approaches

Monitor Social Dimension of Higher Education

- threat of a new “Digital Divide”
- heterogeneous groups / communities
- differences between fields of study / areas
- social barriers?
  (part time students,...)
- new barriers for specific groups

→ need for accessibility, usability
→ gender adequate educational design
→ need for support

European Higher Education Area
Student Centred Learning, Active Learning

EHEA – Trends and Challenges

EUA Report: Trends V

e.g.:

- widening access
- recognition of prior learning
- involvement of societal stakeholders


Trends and Challenges

TREE Project:
Teaching and Research in Engineering in Europe

- TOOLS and OUTCOMES along 4 lines:
  (A) TUNING
  (B) EDUCATION & RESEARCH
  (C) ENHANCING THE ATTRACTIVENESS OF EE
  (D) SUSTAINABILITY
- many Special Interest Groups (SIG) targeted to specific tools
Tree Special Interest Groups

**A: TUNING LINE**

- **A1** Increasing the quality of the majority - a key challenge
- **A2** From ECTS to a complete qualification profiling in EE
- **A3** Inquiry about real needs of industries in international formation
- **A4** Tools for Quality Assurance and Assessment of EE
- **A5** Accreditation of EE in Europe
- **A6** Updating of the Glossary in EE
- **A7** Guide of Engineering Schools in Europe
- **A8** Engineering Demand and Offer in Europe

**B: EDUCATION & RESEARCH LINE**

- **B1** Synergies between research and education activities
- **B2** Status of doctoral (PhD) studies in engineering in Europe
- **B3** Facilitating multidisciplinary projects international teams
- **B4** Engineering students in European research programmes (SIG closed and only partially merged with SIG B6)
- **B5** Problem based and project oriented learning
- **B6** Stimulating undergraduate research
C: ENHANCING THE ATTRACTIVENESS OF EE LINE

- C1 Promoting Higher Engineering Education in Europe
- C2 Register of curricula and courses delivered in foreign languages (SIG closed and only partially merged with SIG A7)
- C3 Identification of tools for enhancing Tempus projects in EE
- C4 Promotion of pedagogical abilities of eng. teachers
- C5 Status of double degrees in EE in Europe
- C6 Widening participation in EE for under-represented groups
- C7 Attracting and retaining female students
- C8 The role of extra-curricular activities

D: SUSTAINABILITY LINE

- D1 Managing continuing engineering education (CEE) effectively
- D2 Examples of good practice in open and distant learning (ODL)
- D3 Effective use of ICT
- D4 Virtual campuses and their global network
- D5 EFQM concept for managing university change
- D6 Ethical issues in EE
- D7 The formation of good adult learners
- D8 Work-based learning
- D9 Active Learning
**TREE Project: Key Challenges**

1. EE in Europe and Globalisation
2. Entrepreneurship
3. The need for a strong ethical formation
4. The challenge of attracting the best young minds
5. Implement effectively the Bologna three-tier system
6. Improve the pedagogical abilities of teachers
7. Exploit the learning potential of research activity...
8. Forming good autonomous adult learners...
9. A well recognised European accreditation system...
10. Improve and augment high quality LLL opportunities

[Borri/Maffioli (2007), pp.162-171]

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**E-Learning: Trends and Challenges**

**TREE Project: Trends, Challenges**

- sustainability
- networking and co-operation
- active learning
- work based learning
- project based learning, problem oriented learning

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**Technology, Internet Access**

- increased and increasing bandwidth at (relatively) low costs
  - enables multi-media application, simulations,...
  - universities, lecture rooms equipped with WiFi

- the „Internet Generation“ enters the university
  - students have become more „web literate“ (often more than teachers)
  - number of Internet users nearly 100%
  - laptops in „classes“
  - BUT: very heterogeneous
E-Learning: Trends, Challenges

„Content Crisis“

• increasing demand for simulation, multi-media,...
• economies of scale → re-use material
• information, meta-data
• „standardisation“ for content and courses
• networking (sharing content requires mutual trust)
• copyright, ownership, licensing, legal issues
• open content, Creative Commons Licensing

Standardisation

has commenced at a „technological“ level (SCORM, LD)
difficult & cumbersome at application level / for users

Efficiency & Effectiveness of Teaching & Learning

• E-Learning is able to reduce resources for administration of education
• but making a low quality course available on the web does not result in a high quality course
• required: attitude towards quality
• effective teaching needs careful educational planning

→ this rather increases costs and efforts, instead of decreasing them
“Recruiting” of Students

- engineering and science curricula show decreasing number of students
- high drop-out rates, especially during first year
- relatively low number of female students

Different Types of Learning

- “know-that”: factual knowledge
- “know-how”: procedural knowledge
- “can do”: mastery, proficiency

→ requires different educational approaches
→ new roles: teachers ↔ learners

know that

- information, facts
- written online learning material: informative texts
- practitioners are interested in facts only when relevant for immediate work
- collect clues where and how to find info

know how

- skills, hands-on experience
- experimenting in a learning setting
- high importance for professionals and practitioners
- most of actual learning in this context
can do

- transfer of knowledge and skills to personal practice
- practical problem solving: “real life” projects
- just-in-time-learning (limitation on resources)

Learning by Professionals

- most important: hands-on experience immediate benefit
  basis for mentoring network
- highly interactive:
  requires intensive support & facilitation
- “teachers” may be only a little more experienced than learners – and only in specific areas

Teacher Centred or Student Centred Education?

- face-to-face teaching: often teacher centred
- history of distance learning and E-Learning:
  often „technology driven“, „technology centred“
- introduction of E-Learning may enable to focus on learners and learning processes
- potential (e.g. social software,...) often not (yet) used (at least in formal learning)

European Higher Education Area
implications for E-Learning
trends and challenges for E-Learning

E-Learning Centre @ Vienna University of Technology
history, activities, services
projects and ideas to meet the challenges posed by EHEA
History

• University Extension Centre (Außeninstitut): Synergy
  Research Information – Technology Transfer – Continuing Education – International Relations
• (Open &) Distance Learning und E-Learning: new media and methods in continuing education
• E-Learning in Continuing Education: (EU-)Projects (e.g. FACILE, ICETEL)
  Courses (EcoDesign, Process Management, Business Plans for Start-Ups, ...)
• new university law
  → E-Learning Centre
  → E-Learning Board
History: E-Learning at TU Wien

- many projects at various departments, e.g. iChemLab, iChemEdu, virtual campus in architecture, MODULOR, virtuELA (virtual EuroLaser Academy), ESPACE, NUPEX, eBooks, FACILE, ICETEL, ...
- activities by pioneering teachers
- results often not sustainable (depending on project funding and on single teachers)

Tasks of the E-Learning Centre

Objectives, Background
- support the university's E-Learning activities
- sustainability (from projects to services)
- few resources – development in small steps

Short Term
- information: web portal, events (E-Learning Days)
- Networking among activists (TU Wien, fnma)
- E-Learning elements in initial education

Medium to Long Term
- services to support E-Learning activities
- re-use of learning material

E-Learning Centre – Targets

- increased use of ICT in education:
  - centrally supported and maintained LMS Moodle
  - simplification of administration by interfaces among systems
- increased quality and efficiency in education
  - qualification of teachers and tutors
  - services for „rapid content creation“
  - support for teachers and students
  - establishing quality standards
- marketing and motivation
- commercial use of learning material
- change attitudes: application of E-Learning as a matter of course

bm:bwk funding – Delta 3

http://www.delta3.at
• 3 partners:
  - Vienna University of Technology
  - University of Natural Resources and Applied Life Sciences, Vienna
  - Academy of Fine Arts, Vienna

• focus their e-learning and e-teaching strategies on
  3 target groups:
  - teachers
  - learners in initial & continuing education
  - general public

• by progress and synergies in
  3 areas of competence:
  - didactics
  - technology
  - design & usability

(Jointly) Develop E-Learning/E-Teaching Strategy

• initiatives by pioneers
  → sustainability of results and experiences

• from pioneering to institutionalisation

• increase proportion of online courses
  → apply innovative didactic strategies for
    teaching complex content
  → intensify learning processes
  → improve quality
  → include disadvantaged groups of students

• complementarity among partners
  • “emerging” strategies

• internal and inter-university co-operation

• trans-disciplinarity

• generate
  “public awareness of science and arts”

• through relations between the corners of the
  3 “e-learning triangles”

Gender Mainstreaming

• ensure that e-learning does not discriminate against women

• lectures with gender specific contents

• workshops, seminars for teachers

• E-Gender platform
  http://egender.akbild.ac.at/

• interest young women for a scientific or engineering field of study
Multi-Level Support Network

Synergy, Complementarity
- very heterogeneous partnership
- different viewpoints on specific problems
- inter-disciplinarity
- trans-disciplinarity
- arts and science web portal to attract future students

Activities and Services

E-Learning Partners
Students
Teachers
Institution
TU Wien E-Learning Centre Services

E-Learning Centre

Information, Networking
- events
- EL-Impulse, EL-Day
- homepage
- http://elearning.tuwien.ac.at
- marketing
- mobilisation

E-Learning Services
- TUWEL based on Moodle
- tools
- content creation
- qualification

Educational Development
- awareness
- for quality
- incentives
- coaching
- projects with
- univ.teachers

Management and Organisation:
- administration
- internal evaluation
- and quality assessment

Team

- early 2004:
  - 5 persons

- early 2008:
  - 11 persons,
  - 8.8 full time equivalents

- backgrounds from different disciplines
  - computer science
  - mechanical engineering
  - civil engineering
  - surveying
  - architecture
  - psychology
  - educational science

Networking, Information, Incentives

http://elearning.tuwien.ac.at/
- E-Learning Day (1 / year)
- E-Learning Impulse Events (5 / year)
- Website – Information, FAQs,...
- co-operation with other universities
- etc.

- Information Events - Examples
  - Forums, Weblogs & Wikis in Teaching and Learning
  - Bologna, E-Learning, Gender Mainstreaming: Leap in Quality or Break Shoe for Education?
  - E-Learning Impulse: E-Tutors – Roles and Tasks, Costs and Benefits
  - E-Learning Impulse: Blended Learning is Expensive – but it’s Effective!
  - E-Learning Impulse: Moodle – News and Announcements
  - E-Learning Days: Competent Application of New Media
  - E-Learning off the Beaten Track

http://elearning.tuwien.ac.at/index.php?id=archiv

E-Learning Award 2007

E-Learning Award for excellence in (media supported) teaching

E-Learning Services
Support
reduce obstacles and barriers for teachers
• integrated
• context-sensitive
• problem- and solution-oriented
• low threshold
• multi-level support network
• adequate for any amount of time available

Wide Spectrum of Support Services
• online FAQs
• short explanations
• online articles
• helpdesk (telephone, e-mail)
• consultancy (application of LMS and other tools, organisation of online courses, educational design, production of learning material,...)
• qualification of teaching staff
• coaching
• support for generating projects

Qualification of Teaching Staff
• workshops
• modular programme
• different levels (basic to complex)
• different areas
  - application of TUWEL
  - content creation
  - educational aspects
  - gender mainstreaming
• so far, more participants in “technical” workshops than in “educational” ones

TUWEL = TU Wien E-Learning
• consulting & coaching
• workshops
• E-Learning impulse events
• helpdesk
• TUWEL Online Learning Services
  Moodle & TUWIS++ Connection
TUWEL
LMS based on Moodle

• shared resources
• simplification of organisational aspects of teaching
• reduction of administration overhead
• stimulation of collaborative learning
• enhanced student support

TUWEL Technology

Moodle 1.8
www.moodle.org
Linux + Apache
PHP + MySQL
High Availability
Hardware System

TUWEL Benefits

• shared resources
• simplification of organisational aspects of teaching
• reduction of administration overhead
• stimulation of collaborative learning
• enhanced student support

TUWEL Structure

students & teachers

TUWEL Moodle

moodle activities
exercises, quiz, forum, chat...

content internal
lecture notes, templates, examples...
html, pdf, ppt, xls, swf, scorm, ...

content external
links to Medienbank /Chemlab /CMS /Websites

TUWEL Services
E-Learning Consulting
Content Creation Support
teachers, students, and courses from 2007
active teachers (incl. tutors), accumulated: 803
active students, accumulated: 10,930

<table>
<thead>
<tr>
<th>Courses</th>
<th>Teachers (incl. Tutors)</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005/06S</td>
<td>45</td>
<td>86</td>
</tr>
<tr>
<td>2006/07W</td>
<td>141</td>
<td>334</td>
</tr>
<tr>
<td>2006/07S</td>
<td>166</td>
<td>392</td>
</tr>
<tr>
<td>2007/08W</td>
<td>169</td>
<td>347</td>
</tr>
</tbody>
</table>

• 13,500 users (students & teachers)
• 3000+ active users/day
• 70,000 visitors/month
• 1,900,000+ pages/month
TUWEL High Availability E-Learning Service

- **High Performance:**
  - "peak loads" during online examinations
- **High Availability:**
  - multiple redundant servers in different locations, automatic failover

System Design – High Performance

- elz01.ai.tuwien.ac.at
  - Wiedner Hauptstraße
  - Apache 2, MySQL, Postfix
- elz02.ai.tuwien.ac.at
  - Favoritenstraße
  - Apache 2, MySQL, Postfix

Heartbeat

System Design – High Availability

- elz01.ai.tuwien.ac.at
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Heartbeat
**Server Hardware**

- 2HE Hewlett Packard DL380 G5
- 2x Intel Xeon Quad Core 2,33GHz (8 Cores)
- 16GB RAM
- 580GB RAID5 - SAS HDD Array
- Battery Backup Raid Controller 256MB Cache
- 4x Gigabit LAN Copper
- CD/DVD Combo
- 2x Hot-Swap power supply 1000W
- 1000VA USV for 15-30 minutes
- iLO Remote Management Console

**Server Software**

- SuSE Linux Enterprise Server 10
- DRBD 0.7.x
- Heartbeat 2
- Apache 2
- MySQL 4.x
- PHP 5.x
- Moodle 1.8.1+
- Postfix

**TUWEL / Moodle - course author features**

- **Mathematical Notation**
  \[ e^{-i\pi}+1=0 \]

- **Multimedia Plugin**
  .mp3, .avi, .mpg, .swf, .flv?d=320x240

- **Syntactic Highlighting of Code**
  [code lang] your.code [/code]

- **Jmol Molecular renderer**
Media example - chemistry

TUWEL Toolbox

TUWEL Outlook

- terms of use for TUWEL
- faculty specific TUWEL course creation workshops
- E-Learning tutorials
- train the trainer program
- extension of the E-Learning service website
- further enhancement and faculty specific development of TUWEL/moodle features and add-ons.
- content strategies
Participation in Projects


EU Projects

- **EQIBELT**
  Education Quality Improvement by E-Learning Technology (Croatia)

- **OpenDock**
  create a corpus of learning materials... published under the Creative Commons license, with provision for IMS Learning Design, drawn from a range of different sectors of VET from different languages and cultures... establish a repository of learning resources...

EU-Project Applications – 2007, not successful

- **IELQLO**
  Impact of E-Learning in Quality and Learning Outcomes

- **CEREC**
  Cooperation of Existing Resources of E-Learning Courses
• **IELQLO** – modified proposal
  Impact of E-Learning in Quality and Learning Outcomes

• **CEREC**
  Cooperation of Existing Resources of E-Learning Courses

• **TREE TWO** – especially:
  handbook to address tools for the full exploitation of students’ learning potential
  → challenges of future professional life
  → implementation of the Bologna Process
  → effective use of ICT to make activities more productive
  → relations with research

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Educational Development
Projects and Ideas

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Mobility, Virtual European Higher Education Area

• complement physical mobility with virtual mobility:
  internationalisation of virtual campus initiatives
  co-operation between
  traditional / dual-mode universities and open / virtual universities

• support physical mobility with ICT:
  preparation of study visits
  follow-up on study visits
  support guest teaching

• complement face-to-face courses:
  team work among students from different regions

• networking

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Evaluation, Quality Assessment

• internal procedures for quality assessment:
  regular evaluation of lecturers by the students
  specific evaluation for courses with E-Learning elements
  [proposal by the E-Learning Centre under investigation]

• Analysis of the Status of E-Learning
  + additional consulting

• Learning Quality Management System
  (module in TUWEL/Moodle)
Evaluation, Quality Assessment

• Learning Quality Management System
  possibility for feedback (and reminders) early on

Attractiveness for new Students

• provide orientation for future students
  co-operation with schools (even in research)
  make attractive learning material available
  for school teachers

• decrease drop-out rate
  support, specific introductory courses
  more attractive curricula
  (more than [math.] theory during first year)

• “illustrative” teaching (e.g. simulations,...)

• attract female students

• attract under-represented groups
  (p. w. disabilities, rural areas, minorities, migrants, refugees, adult/work based learners,...)

LifeLong Learning

• experiences with practitioners as learners

• active facilitation of learners and of the
  learning process

• re-use of learning material
  ➔ content management

• networking with partners

• prepare (under-graduate and graduate) students
  for lifelong learning
  ➔ research, content-generation
  ➔ supported by „social software“

Research-Based Learning

Jenkins et al. (2007): http://www.heacademy.ac.uk/assets/York/documents/LinkingTeachingAndResearch_April07.pdf
• from research-led teaching to research-based learning

• Including research not only in third (and second) cycle, but also in (second and) first cycle
  → involve undergraduates in research
  → co-operate with secondary schools ("sparkling science" programme)

• tools and services to support knowledge generation by students
Work Based Learning

- the border between learning and work is disappearing: learning-by-doing, learning-on-demand,…
- newly gained knowledge can be applied immediately
- learning on the job: attempting to solve “real world” problems
- such problems do not fit into borders between disciplines
  → trans-disciplinary scenarios

Networking with Partners

- Experiences from Delta 3
  heterogeneous partnership takes time, requires effort may result in gaining additional viewpoints, more sustainable results
- Forum Neue Medien Austria (fnma)
  members: (nearly) all Austrian Universities
- AG Moodle within fnma
  synergies in development
- ELENOR E-Learning Netzwerk Ostregion
  information exchange, joint marketing, scheduling, organisation of events
- International Projects

Content Sharing

- Content Synergies
  re-use of learning material in different courses (intra- and inter-university)
- Content Management
  looking for software which is easy-to-apply define requirements for the university content management does not stop with learning:
  → research, publication
  → asset management
- Media Management
  internal project (in statu nascendi)

Legal Issues:
who owns the learning material? who may use the learning material? under what terms and conditions?

Different Models:
peer-to-peer, bi-lateral/multi-lateral agreements content pools and repositories („copy-left“) common courses, joint curricula

Personal Issues (atmosphere of mutual trust,…)

2 experiments with the peer-to-peer model:
started in Delta 3:
- barrier-free design (TU Wien & AkBild),
- Geographical Information Systems (TU Wien & BOKU)
Learner Support, E-Tutoring

- **Course „Practice of E-Tutoring“**
  3 days basic instruction for E-Tutors

- **Coaching for E-Tutors**
  based on course „Practice of E-Tutoring“:
  coaching and consulting during
  occupation of E-Tutors
  exchange of experiences, supervision

- **Development of additional modules for**
  qualification of tutors and teachers

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**Figure 7: Different formats of Active Learning**


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**Table 2. PBL versus Other Active Learning Strategies**

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Active Learning, Problem Based Learning

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EDEN Annual Conference 2007
paper by Csanyi, Pohl, Reichl

informal tools for efficient learning library
www.informatik-forum.at
team-building with Google Docs
team-building with Skype

semi-formal scenarios
tandem (language) learning
tutorial programmes

Figure 1: Input-Output Relation for Formal and Informal Learning (Cross 2006)

informal learning

- characteristics of informal learning scenarios
  - social situations
  - non-hierarchical
  - self-controlled, trustful (exclusion of teachers / "assessors")
  - versatile goals, "hidden" curricula

- success factors
  - communication skills, computer/web literacy
  - open access
  - usability
  - work-life-balance
  - trustful atmosphere – no “sanctions”
  - legal questions

- important additional resource
  - learning / understanding was always personal lectures etc. trigger/stimulate the learning process

- "peaceful co-existence"
  - of formal and informal learning

- assignments with open structured problems

- ICT support
students and accreditation

- „Studying Paths“
  visualisation of curricula and individual status of accreditations and progress of studying based on existing data

- Recognition of Knowledge
  gained outside of the formal curriculum

- E-Portfolios

- Acquisition of new/additional Students

- Support for Students during their first Semester(s)

additional projects and ideas

- online examinations
  examinations in large courses with TUWEL and other LMS

- intra-university projects
  e.g. iRecord – Architecture & Regional Planning
  “Brückenkurse” – Mathematics Courses bridging the gap between secondary schools and the university (for all engineering students)

- use of mobile devices
  Streaming und PodCasting