Institute of Information Systems and New Media, WUW

Lunch-Talk, OUNL, Heerlen, 13.11.2006

Fridolin Wild
Vienna University of Economics and Business Administration
My Plan: One Nervous Breakdown Here in this Room

- Technology-Enhanced Learning at my University: learn@WU
- Technology-Enhanced Learning in Austria and (mainly) New Europe
- Research at the Institute for IS & NM
  - Short iCamp Introduction
- Two Hot Topics we are Researching in
  - TEL Interoperability
  - Automated Competence Assessment (ACA)
  - Two Examples for ACA
TECHNOLOGY-ENHANCED LEARNING AT THE WUW: LEARN@WU
Key Facts Learn@WU

- **Initial Project:**
  - Start: Autumn 2001, 2 Years, Budget: 3.4 M €
  - 36 Full Time Content Developer (2 per Course)
  - 2 people didactic support, 2 people technical support (incl. help desk)
  - **Content** (not platform) **Project**

- **From Project to Infrastructure:**
  - 2002: Deployment of First Version based on OpenACS
  - 2003: TEL became a Strategic Goal of the University
  - 2004: Relaunch based on dotLRN (+ own Components)
  - Since 2005:
    - TEL is part of Trainee programs
    - Development of an In-House e-Learning Academy
    - Currently 48 People employed
    - More than 250 Content Developers
Current Status learn@WU

- More than 37,000 Learning Resources developed
- Broad Acceptance
  - More than 2,000 courses
  - More than 29,000 registered members (mostly students)
  - Students solve up to 380,000 interactive exercises per day
  - More than 120,000 exams through mark-reader
- Technical Figures
  - Up to 4.3 Mio requests (hits) per day from registered users
  - Average response time less 0.4 sec
  - Up to 41 GB/Day traffic
- Current annual growth rate: 10-20%
- One of the most intensively used TEL platforms world-wide

“Without Learn@WU, the operations of our university would not have been possible.“

– Christoph Badelt, WUW President
Collaborative Learning and Teaching Environment

- **Community Framework**
  - University as a „community of communities“
  - Communities composed of
    - Groups of students, classes, courses, programs, alumni, ...
    - Members and administrators (decentralized management)
  - Communities are provided with tools
  - Administrators tailor communities according to their needs

- **Collaboration and Teaching Tools**
  - General Collaboration Tools: Calendar, Announcements, Chat, Forum, File-Store, Weblog, Wiki, ...
  - Teaching Tools: Syllabus, Homework, Problem Based Learning, Room Reservation, ...
  - Decentralized Management: e.g. teacher configures a class community with tools suitable for his teaching concepts
Willkommen bei Learn@WU

- Allgemeine Informationen zu Learn@WU
- Projekt-koordinatorInnen
- Angebot an Lehrmaterialen der Plattform
- Funktionalitäten des Systems
- Hilfestellung bei Anfragen und der Nutzung von Learn@WU

Die E-Learning-Plattform der Wirtschaftsuniversität Wien ist die zentrale Anlaufstelle für Studierende und LehreInnen, um Informationen zurückzubuchen, Wissens zu vermitteln und Kommunikation zu ermöglichen. Die WU-Wien komplettiert damit ihr Bildungsangebot und trägt weiter dazu bei, herausragendes Wissen, einzigartige Ausbildung und zukunftsweisende Innovationen zu garantieren.

Learn@WU-Aktuell

Erscheinen der Kurse in Learn@WU nach Schienenanmeldung (04.19.2006)

Im Rahmen der "Einführungsveranstaltung für Erstsemester" wurde erwähnt, dass inskribierte Kurse auf Learn@WU auf der persönlichen Platztabelle der Mitgliedschaften aufgeführt (sofern diese von Learn@WU unterstützt werden). Dabei blieb leider unklar, zu welchem Zeitpunkt diese Kurse aufgeführt werden, wenn die Anmeldung wegen Schichten erfolgt. Die Kurse erscheinen erfahrungsgemäß nach der Inkorporation der Kurse nach der Ende der Frühjahrssemester. Vielmehr ist ausdrücklich durch das ZIB bis zum Beginn der Regelzahlenanmeldung für die jeweilige Kurse die Einführung der Studierenden noch nicht definitiv. Daher sollten diese bis zu diesem Zeitpunkt nicht in Learn@WU auftreten. Wir bitten Sie daher um etwas Geduld, bzw. können Sie auf die Inhalte der Kurse bereits ansehen, indem Sie dessen Titel mittels der LV-Quidita auf Ihrem persönlichen Portal auswählen.

PC Hardware Workshop für Frauen für Frauen (14.09.2006)


Die Workshops bieten zwei Tage Zeit, um einen Computer in seinen Einzelteile zu zerlegen, mehr über die Funktionsweise der Teile und ihr Zusammenwirken sowie die Rechner anschließend wieder zusammenzubauen, das Betriebssystem installieren und danach die Rechner untereinander in einem kleinen Netzwerk zusammenzuschließen. Die Arbeit erfolgt ausschließlich in Kleingruppen und ermöglicht so eine individuelle Betreuung durch die Veranstalter.
TECHNOLOGY-ENHANCED LEARNING IN AUSTRIA AND (MAINLY) NEW EUROPE
Open Questions

- Characteristics of Learning Tools Portfolio?
- Support for Collaboration and Social Awareness?
- Sharing & Re-Use?
- In Austria?

⇒ In Comparison to Other Countries?
Methodology

- Descriptive Study (Picciano, 2004)
- Part of Study on Higher Education Institutions in (mainly) New Europe
- Performed by iCamp & ProLearn
- Overall: 26 countries (varying completeness)
- 44 Questions in 7 groups, breaking down to 118 variables
- 23 responses from Austria, 100 overall
- Developed: Jan/Feb 2006
  - Pre-Test
  - Analysis through Advisory Board
  - Adaptation by Core Team
- Conducted: Mar-July 2006

http://www.prolearn-project.org/
http://www.icamp.eu/
### Characteristics (Tools Portfolio)

**L(C)MS:** Blackboard, CeWEbs (S), CIS (S), DMA, Dynamic PowerTrainer, ELGG, eNcephalon (S), Hyperwave, Ilias, KUG-Online, Learn@WU (S), lerndorf (S), Moodle, MS Class Server, n.n. (S), n.n. (S), n.n. (S), n.n. (S), n.n. (S), Portal (S), TUWIS (S), Virtual Medical Campus (S), VUW++ (S), WBT Master (S), WebCT

**Pure AUTH:** cmap, Dreamweaver, exe, Framemaker, Hot Potatoes, nvu, xmlSpy

**Pure ASS:** DHS, Speedwell Question Bank, Forms 5, n.n. (S), n.n. (S)

**Pure LOR:** COL learning object repository, Cumulus, easyDB, EducaNext (S), HCD-Suite (S), IAEM (S), M-BOX, n.n. (S), pakXchange

**Pure AIS:** BACH (S), LPIS (S), i3v, n.n. (S)

**Pure CMS:** aloha (S), communicom, Drupal, ELK - CMS (S), ePrints, Plone, Stream Server, Typo3, Wordpress, XIMS (S)

**Pure COLL:** Breeze, BSCW, Campus Pack for Blackboard, CGI:IRC Chat, concert chat, digalo, Interwise, mediaWiki, phpBB, Quicktopic, Tikiwiki, Video Conferencing Software, Virtual Network Computing - VNC, XchangeBoard

<table>
<thead>
<tr>
<th>Types</th>
<th>CMS</th>
<th>AIS</th>
<th>AUTH</th>
<th>LOR</th>
<th>ASS</th>
<th>COLL</th>
</tr>
</thead>
<tbody>
<tr>
<td>L(C)MS</td>
<td>25</td>
<td>10</td>
<td>4</td>
<td>7</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Occurences</td>
<td>43</td>
<td>13</td>
<td>5</td>
<td>9</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Self-Dev</td>
<td>15</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

**Learning (Content) Management …**

- Moodle 12
- (Moodle + Other 9)
- (Moodle + Commerc. 5)

- LRN 1
- Ilias 2

- WebCT 3
- Blackboard 3
- Hyperwave 2

**Institution has (one or more) …**

- Open-Source LMS 14
- Self-Developed LMS 14
- Commercial LMS 11
Characteristics (Tools, Overall)

<table>
<thead>
<tr>
<th>Characteristic Tools</th>
<th>No. Occ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>L(C)MS</td>
<td>71</td>
</tr>
<tr>
<td>Open-Source LMS</td>
<td>47</td>
</tr>
<tr>
<td>Self-Developed LMS</td>
<td>44</td>
</tr>
<tr>
<td>Commercial LMS</td>
<td>42</td>
</tr>
<tr>
<td>Moodle</td>
<td>44</td>
</tr>
<tr>
<td>Moodle + Other</td>
<td>29</td>
</tr>
<tr>
<td>Moodle + Commercial</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 1. Tools by Characteristics (I)

<table>
<thead>
<tr>
<th>Tool</th>
<th>Occ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>WebCT</td>
<td>14</td>
</tr>
<tr>
<td>Blackboard</td>
<td>5</td>
</tr>
<tr>
<td>eDocoo</td>
<td>3</td>
</tr>
<tr>
<td>Discendum Optima</td>
<td>3</td>
</tr>
<tr>
<td>Eden</td>
<td>2</td>
</tr>
<tr>
<td>Fronten</td>
<td>2</td>
</tr>
<tr>
<td>Hyperwave</td>
<td>2</td>
</tr>
<tr>
<td>Ilias</td>
<td>2</td>
</tr>
<tr>
<td>Learning Cubes</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 2. Characteristics (II)

<table>
<thead>
<tr>
<th>Tool</th>
<th>Occ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atractor, Barhovits (S), Blackboard, Campus Online (S), CampusNet (S), eWeBo (S), CIE (S), Claroline (S), Course Management System (S), Digital Media for Artists (S), Discendium Optima, Dossiers Electronic (S), Dynamic Power Trainer, Educa, eDooce, eEducation, e-Learning shell - eLife (S), Eleveon (S), ELGG, ELEIS (S), eNephilon (S), FirstClass, Fronten, Hyperwave, IBM Lotus Learning Space, IBM Lotus LMS, Ilse, IS LMS (S), IVT (S), Jatex (S), Kopp (S), KVL-Online (S), Learn2 edu (S), Learn2LE (S), Learning Management System (S), lernford (S), LMS Education Center, Meters TFE (S), Moodle, MS Class Server, MySchool, OLAT, Orange Solutions Learning Cube, oel (S), Portal (S), Schofis (S), SIS (S), Stadium Online (S), Studium Online (S), Studium Portal (S), Study (S), Theducation, Tibol LE, TUWES (S), Virtual Campus (S), VUW++ (S), WIT Master (S), WCET (S)</td>
<td>15</td>
</tr>
<tr>
<td>aloha (S), blogs (S), comments (S), DiCa (S), DiCa-T (S), Epils- server, ePrints, esa (S), Listserver, Mailing List, Topol, WordP (S), XIMS (S), ZMS</td>
<td>20</td>
</tr>
<tr>
<td>Back (S), Course One (S), DaVinc (S), eLearning electronic study information system (S), EDI (S), Electronic Administration System (S), ISIT (S), SIS (S), Student Information System University Support System (S), LPS (S), MyPlan (S), Neverlost, SCAM (S), ePortfolio (S), TAC (S), Student Registration System (S), Webodi, weBook (S), XMLApp (S), COL Learning Object Repositories, Onibus (S), DILEO (S), easyDB, EducaNet (S), HCD Suite (S), IAEM (S), Inmoov (S), M-BOX (S), Monovest (S), Quicktime Streaming Server, Video Lecturing System VIFS (S), concordia, Digital Homework for Students - DHH (S), Forms S, esa (S), edu (S), prolog, QuestionMark, Speedwell Question Bank, survey (S), Webex</td>
<td>18</td>
</tr>
<tr>
<td>Acrobat, Aalto (S), ApaMatt (S), Breeze Presenter, cmap, Conferences@U of Toledo CDE (S), Dreamweaver, eXs, Gerdos, FreePress, Frontpage, HotPotatoes, HotPotatoes, IBM Learning, E-Learning, Collaborative Authoring Tool, Inscripta, Kolbe (S), Macromedia Captivate, Macromedia Studio MX, Movavi Video Producer, mva, Screencoder, XMLApp</td>
<td>26</td>
</tr>
<tr>
<td>Acelera (S), COL Learning Object Repositories, Onibus (S), DILEO (S), easyDB, EducaNet (S), HCD Suite (S), IAEM (S), Inmoov (S), M-BOX (S), Monovest (S), Quicktime Streaming Server, Video Lecturing System VIFS (S), concordia, Digital Homework for Students - DHH (S), Forms S, edu (S), prolog, QuestionMark, Speedwell Question Bank, survey (S)</td>
<td>51</td>
</tr>
</tbody>
</table>

Table 3. Products

<table>
<thead>
<tr>
<th>Tool</th>
<th>Occ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acelera (S), AviWiki (S), Breeze Meeting, BSWC, Campus Pack (for Blackboard), CCBIRC Chat, Commmly, concert chat, digalo, eGoupware, eMeeting, Facilitate Pro, FlashMeeting, IBM Lotus Sametime, Interview, Learnshare, Mentach, MediasWiki, MS Messenger, MS Outlook Web Edition, Omnipappi (S), phpBB2, PullCom, QuickTopic, Skype, Smartboard, TeamSpot, TikiWiki, WikiConference, Virtual Network Computing - VNC, VIMS, XchangeBoard</td>
<td>61</td>
</tr>
</tbody>
</table>
Characteristics (Users)

Austria: Registered and Active Users vs. People (in % of people)

- **Registered Users**
  - Arithmetic Mean: 6894
  - Standard Deviation: 13878

- **Active Users**
  - Arithmetic Mean: 3988
  - Standard Deviation: 6717

Overall: Registered and Active Users vs. People (in % of people)

- **Registered Users**
  - Arithmetic Mean: 5236
  - Standard Deviation: 8806

- **Active Users**
  - Arithmetic Mean: 2828
  - Standard Deviation: 4643
Characteristics (Courses)

Courses in System (n=13)
- Arithmetic Mean: 501
- Standard Deviation: 582

All Courses (n=12)
- Arithmetic Mean: 1234
- Standard Deviation: 1686

Courses in System (n=79)
- Arithmetic Mean: 242
- Standard Deviation: 401

All Courses (n=63)
- Arithmetic Mean: 1020
- Standard Deviation: 1987
Characteristics (Summary)

- Austria
  - Biggest 3 LMS (Users):
    - learn@WU/.LRN
    - Blackboard
    - WebCT

- Overall Study
  - Biggest 4 LMS (Users):
    - Blackboard
    - WebCT
    - Eleum or Moodle
    - learn@WU (.LRN)
  - Moodle as the only LMS:
    - Ø 663.07 users
    - Max 3600 users
  - All Moodles in Survey:
    - Ø 1800.73 users
    - Max 28.500
Collaboration & Social Awareness
Collaboration (Usage Frequency)

Please rate how frequently the following tools are used...

Indicates lack of support for (social-)constructivist education theories

But: better than in overall study

Collaboration

Delivery

Rare authoring goes hand in hand with rare collaboration

Overall + Austria

Authoring

Course Management

frequent use moderate use infrequent use experimental use never no answer don't know

Austria Overall
Coll. & Soc. Awareness (Opinions)

INSTRUCTORS should intensively share their resources among each other (e.g. course materials, blog entries,...)

Material sharing generally considered important.

INSTRUCTORS must be able to select from a huge variety of tools in support of their teaching activities

More agreement to have a big tools portfolio for instructors to choose from.

STUDENTS need to have tools support for building and sustaining social networks

Shows demand for support (social networking functionality supported by tools portfolio: 30% Austria, 34% Overall)!

STUDENTS should intensively share their contributions among each other (e.g. materials prepared for courses, blog entries,...)

Opinions vary about tools portfolio sizes for students.
Repository Interoperability

LOR accessible from outside (18/100)
Cross-organisational repository network (16/100)

Austria:

Cross-Organisational Repository Network
Repository is accessible

Unis (11)  Colleges (12)
3  4  1

But still … !

Primary Mode for Sharing of Learning Resources (%)
Summary Study (I)

- Quite Heterogeneous Landscape of Tools:
  - 182 different tools (100 Universities!)
  - In 290 installations

- Strengths
  - In General:
    - Text-based Communication, Assessment Features
    - Quality Assurance, Individual Publishing Features
  - In Austria:
    - Stronger in Collaborative Publishing Features
    - More than 50% (Overall: 46%) have more than 60% of their students registered in the systems
    - In average more than double as many TEL-enriched courses than Overall

Attention: compared against only (mainly) New Europe!
Summary Study (II)

▪ Shortcomings

▪ In General:
  • Social Networking Features (but: judged very important!)
  • Interoperability of Repositories (but: judged important!)
  • Collaboration
    – Features missing
    – e.g. AV-Broadcasting / Conferencing
    – Existing Collaboration Facilities rather rarely used

▪ Additionally weaker in Austria:
  • Features for Authoring of Learning Designs
RESEARCH & RESEARCH PROJECTS
Research

Headed by Gustaf Neumann

~ 33 people (plus several open positions)
Research Projects

- Past Projects
  - Universal, Elena, TEN-A, …

- Current Bigger Projects
  - Prolix (IP, IST)
  - ProLearn (NOE, IST)
  - iCamp (STREP, IST)
  - E-Learning / e-Teaching Strategy (bm:bwk)
iCamp Vision …

… to become **THE** Educational Web for Higher Education in an Enlarged Europe of 25+
Organisation of Work

 WP6
 project management & assessment

 WP1
 pedagogical models

 WP2
 enablers & building blocks

 WP3
 integration

 WP4
 validation trials

 WP5
 dissemination & exploitation

 ... now :)  
... beginning: survey on tools
... later: interoperability

... later: competence assessment
Areas of challenge...

Competence Achievement in ...
augmented landscape

Missing link from the models to the infrastructure: activity theory
SELECTED HOT TOPIC IN MORE DEPTH:
TEL INTEROPERABILITY
TEL Interoperability

- Repository Interoperability
  - Retrieval Interface (SQI)
  - Federated Search for Digital Libraries / Learning Object Repositories
  - Aggregation / Mediation Services
- Next Step: Collaboration oriented Interoperability
  - Blog interoperability
  - Aggregation
  - Rip, Mix & Feed Steering Interfaces
Interoperability

is a **property** that emerges, when
**distinctive information systems** (subsystems)
cooperatively **exchange data**
in such a way that
they **facilitate** the
**successful accomplishment**
of an overarching **task**.
Concept of Interoperability

(modified from Kosanke, 2005; IEC, 2005)
Theoretical Approaches

- Information Integration & Dissemination for Learning
  - Data Integration vs. Data Exchange
  - Information Querying
  - Information Filtering

- Remoting: Service Orientation for Learning Services

- Presentation Integration: Portlets
  - i.e. the learner‘s front-ends
  - e.g. Web Services for Remote Portlets (WSRP)
Interoperability Stack: Combines Remoting and Information I & D

Context

- e.g. personnel development of five higher education medicine faculties in Germany
  - e.g. elena common schema
  - e.g. ariadne lom

(Atomic & Composite) Application Services

- Common Schema
- Data Format
- Messaging Service
- Network Protocol

Use Case
- e.g. federated search
- e.g. course selection agent

Representation

Communication

- SOAP
- e.g. HTTP
- or e.g. TCP/IP

or e.g. JRMI

- e.g. XML
- or e.g. XML/RDF, or e.g. relational DB
Interoperability: Retrieval via SQI

Query Language, Schema

Learning Repository A (Source)

Transport: SQI

Common Query Language

Result Format, Schema

Result Set

Learning Repository B (Target)
Federated Search

R ... SQI-enabled repositories ("targets"), e.g. OISter, Elsevier, Amazon, ...

(3) federating request (request: keyword bag, response: RSS [title, description, url])
using xosoap / xorb consumer

(2) pre-processing requests / post-processing responses
using xosoap / xorb provider

(1) collecting requests (request: keyword bag, response: RSS [title, description, url])

Remote SQI sources
Examples for Patterns

- Proxy
  - Translator: QEL-to-Bag-Converter
  - Extender: Object Cache etc.

- Wrapper
  - Translator: QEL-to-RDQL-Converter

- Broker
  - Translator: QEL-to-Simple-Bag-Converter
  - Extender: Object Cache etc.
  - Controller: Query Engine (Query Plan), HTTP routing
Next Step

- Integration
  - of federated search („retrieve“) technology
  - with feed structures („publish/subscribe“)

- i.e. Integration
  - of ad-hoc retrieval
  - and information filtering (standing queries)
From Federation to Information Integration & Dissemination

R ... SQI-enabled repositories ("targets"), e.g. OlSter, Elsevier, Amazon, ...

1. Collecting requests (request: keyword bag, response: RSS [title, description, url])
   - Using xosoap/xorb provider

2. Pre-processing requests / post-processing responses
   - Using xosoap/xorb consumer

3. Federating request (request: keyword bag, response: RSS [title, description, url])
   - Using xosoap/xorb consumer

"Standing queries"
Search is an Iterative Process

begin

Processing

Results Display

Reformulation

Evaluate Results

Satisfied?

yes

no

Turn into Search Portlet to encapsulate end-user functionality in an interoperable building block
SELECTED HOT TOPIC IN MORE DEPTH:
AUTOMATED COMPETENCE ASSESSMENT
The History of Competence

1947
Developmental Sciences (Piaget): general intellectual abilities with strong and stable inter-individual differences

1920ies
Analysis of human action: underlying abilities needed for high performance

1959
Psychology (White): motivational aspects

1965
Linguistics (Chomsky): limited system of inborn linguistic principles, abstract rules, and basic cognitive elements

1973
Industrial Psychology (McClelland): superior job performance

1990
Organisation (Pralad & Hamel): collective competence

2003
OECD (Rychen & Salganik): successful life and well-functioning society

... just a selection ...
“A competence is defined as the ability to successfully meet complex demands in a particular context through the mobilization of psychosocial prerequisites (including both cognitive and noncognitive aspects)”

(Rychen & Salganik, 2003b, p. 43)
Definition (II)

- Competence is
- a human potentiality for action,
- which is:
  - Demand oriented (= abilities required for e.g. task)
  - Refers to abilities that can be learned
  - Involves cognitive and noncognitive elements
    - factual knowledge, procedural skills, internalised orientations, values, attitudes, volitional aspects, …
Competence Classes (I)

- Excerpted from empirical, political, and theoretical perspectives (see paper) …

- **Professional competence**
  - basic and specialized general knowledge, basic psychomotor and mechanical skills, and disciplinary and interdisciplinary knowledge (Jäger, 2001)

- **Methodological competence**
  - ability to independently acquire, structure, critically evaluate, and exploit knowledge in a creative way (Kauffeld et al., 2003)
Competence Classes (II)

- **Social Competence**
  - facilitate communicative and cooperative action and that aim at identifying, managing and mastering conflicts (Erpenbeck, 2003)

- **Personal Competence**
  - concerned with those attitudes and character attributes required to perceive and utilize one’s own competencies and to act in a reflective and self-reflective way (Erpenbeck, 2003)
## Important Competences

<table>
<thead>
<tr>
<th>Professional Competence</th>
<th>Methodological Competence</th>
<th>Social Competence</th>
<th>Personal Competence</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Gayk, 2003)</td>
<td>Analytical thinking</td>
<td>Communication</td>
<td>Work under pressure</td>
</tr>
<tr>
<td>(Schaefer &amp; Briedis, 2004)</td>
<td>Domain-specific professional competence</td>
<td>Social competence</td>
<td></td>
</tr>
<tr>
<td>(Gonzales &amp; Wagenaar, 2003)</td>
<td>Basic general knowledge</td>
<td>Analysis and synthesis; capacity to learn; problem solving</td>
<td></td>
</tr>
<tr>
<td>(European Commission, 2002a)</td>
<td>Mother tongue; Maths</td>
<td>Mother tongue; foreign language; ICT; numeracy; science and technology; entrepreneurship; learning to learn</td>
<td>Interpersonal and civic competences; general culture</td>
</tr>
<tr>
<td>(European Commission, 2002a)</td>
<td>Problem-solving</td>
<td>Communication; working with others</td>
<td></td>
</tr>
<tr>
<td>(National Postsecondary Education Cooperative, 2002)</td>
<td>Information technology; critical-thinking; problem-solving</td>
<td>Communication</td>
<td></td>
</tr>
<tr>
<td>(Weidert, 2001)</td>
<td>Mother tongue; mathematical knowledge</td>
<td>Mother tongue; reading; foreign language; media; learning strategies; divergent thinking; critical judgment; and self-criticism</td>
<td>Social competencies</td>
</tr>
<tr>
<td>(Centro Sperber &amp; Dippel, 2001)</td>
<td>Perception competencies; narrative competencies</td>
<td>Cooperative competencies</td>
<td>Coping with complexity; normative competences</td>
</tr>
<tr>
<td>(Reichen &amp; Salganik, 2003a)</td>
<td>Using tools interactively</td>
<td>Joining and functioning in socially heterogeneous groups</td>
<td>Acting autonomously and reflectively</td>
</tr>
</tbody>
</table>
Automated Measurement

- Four Different Types of Approaches
  - Multiple-Choice Approaches
  - Simulations
    - Virtual labs, online experiments, games
    - From simple click-thru to sophisticated MM
    - Underlying model used to evaluate performance
  - Graph-Based Approaches
    - Based on formalisms such as: concept maps, knowledge maps, mind maps, topic maps, ontologies, Petri nets, adjacency networks, and affiliation networks (plus many others)
    - Mining approaches (e.g. SNA on eMail interaction)
    - Construction approaches (fill-in-the-map vs. construct-a-map)
Automated Measurement (II)

- Natural Language Processing Approaches (NLP)
  - Syntax-based: structural analysis regardless of meaning
    - Shallow counting (orthography, e.g. Page, 1966)
    - Structural Analysis (e.g. POS-tagger & discourse structure parser)
  - Semantics-based: analysis of the meaning
    - Concept-based
    - Context-based
State of the Field…

- See paper for more
- But: Two examples
  - Social Competency Aspects measure with SNA
    - over interactions within learning communities
    - within scientific communities
  - Professional Competence measure with LSA
    - Essay Scoring
EXAMPLES FOR AUTOMATED COMPETENCE ASSESSMENT
### SNA over Discussion Boards

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SNA over message boards

- Message Board: Business English
- Most central Author 1083 (Highest Degree Centrality, Highest Betweenness)
- => a student!

Calc’ed with k-plex:
- n: number of members to be connected with
- k: number of members no connection is necessary

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SNA over scientific community

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Essay Scoring with LSA

- Domain-specific documents
- Generic background documents

Construct latent semantic space

LSA

Convert vectors

Fold-in

Test essays & gold standard essays

Compare vectors

0.2
0.0
0.8
Folding-In in Detail

(cf. Berry et al., 1995)

\[ m_i = T_k S_k d_i^T \]

(1) convert Original Vector to "\( D_k \)"-format
(2) convert "\( D_k \)"-format vector to "\( M_k \)"-format

\[ d_i = v^T T_k S_k^{-1} \]
library( "lsa" )  # load package

# load training texts
trm = textmatrix( "trainingtexts/" )
trm = lw_bintf( trm ) * gw_idf( trm )  # weighting
space = lsa( trm )  # create an LSA space

# fold-in essays to be tested (including gold standard text)
tem = textmatrix( "testessays/", vocabulary=rownames(trm) )
tem_red = fold_in( tem, space )

# score an essay by comparing with
# gold standard text (very simple method!)
cor( tem_red[,"goldstandard.txt"], tem_red[,"E1.txt"] )
=> 0.7
Benchmarking Effectiveness

- Compare Machine Scores with Human Scores
- Human-to-Human Correlation
  - Usually around 0.6
  - Increased by familiarity between assessors, tighter assessment schemes, …
  - Scores vary even stronger with decreasing subject familiarity (0.8 at high familiarity, worst test -0.07)
- For the whole essay collection from the last slide:
  Rho = 0.687324, compared to pure vector space model with Rho = 0.4475188
BEWARE THE END IS NEAR.