Current trends in e-learning and the impact on the joint SE course

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Agenda

1. E-learning conferences and their subjects
2. Definitions in the field of e-learning
3. Learning objects and their specification
4. MIT open courseware (Semantic Web)
5. Navigation (logic or associative) and search in course material
6. Summary and conclusions

E-Learning Conferences

DeLFI 2003

E-Learn
World Conference on E-Learning in Corporate, Government, Healthcare, & Higher Education

Background of these e-Learning conferences

- DeLFI 2003
  - „German Society of Informatics“, E-Learning group
  - www.DeLFI2003.de
  - Munich, Germany, 3 days
- E-Learn
  - „Association for the Advancement of Computing in Education“
  - Phoenix, Arizona, USA, 5 days
  - http://www.aace.org/conf/eLearn/
- Online-Educa
  - more political and business oriented
  - Berlin, Germany, 3 days
  - http://www.online-educa.com/

AACE Estab. 1981
Association for the Advancement of Computing in Education
Advancing Knowledge & Learning with Information Technology Worldwide

Important common subjects of e-learning conferences

- Didactical Issues
  - Technology supported team teaching
  - Virtual university, virtual classroom
  - ‘blended’ learning
  - Online collaboration
  - Mobile and ambient learning
  - Teacher training
- Production and management of e-learning content and resources
  - Content Development
  - Learning & Content Management Systems
  - Authoring Tools
  - Knowledge Management
  - Electronic Publishing Tools for E-Learning
- e-Learning and XML
  - Metadata
  - Reuse of learning modules
- Distributed Environments (cross-border collaboration)
- Case studies of current e-learning projects
- Quality Issues and Management

Current problems of e-learning projects

- Virtual Universities in USA
  - Low demand for carged online study
  - Virtual Universities services from New York, Temple and Cornell University collapsed

source: COMPUTER ZEITUNG 27/30.07.2003, p.20

- e-Learning solutions often with low return on investment

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Definitions

- No general accepted definition of e-learning.
- 3 selected definitions:
  - GeoLearning
    - Leading e-learning platform provider
  - German Society of Informatics (GI)
  - University of Heidelberg in cooperation with MIT

GeoLearning.com

- One of the leading developers of e-learning delivery platforms and Web-based training solutions.
- Ranked as an industry leader in a recent e-learning client satisfaction study conducted by brandon-hall.com and published in *U.S. News & World Report*.

GeoLearning ranked second out of 24 learning management system companies.

GeoLearning.com – customers and locations

- Some customers: Berlitz, SITEL Corporation, Gov Online Learning Center, Walker and Associates Inc.
  - University of Baltimore, Buckmann Laboratories, DaimlerChrysler, Nortel Networks, VISA, NOAA (Nautic and Atmospheric Administration, U.S. Department of Commerce)

- International offices are located in Paris, France; Sydney, Australia; and Dubai, United Arab Emirates.

source: http://www.geolearning.com

Distance Learning – the superordinate concept of e-learning

"Educational situation in which the instructor and students are separated by time, location, or both."

- Education or training courses are delivered to remote locations via synchronous or asynchronous means of instruction, including written correspondence, text, graphics, audio and videotape, CD-ROM, online learning, audio and video-conferencing, interactive TV, and facsimile.
- Distance learning does not preclude the use of the traditional classroom. The definition of distance learning is broader than and entails the definition of e-learning.

source: http://www.geolearning.com

e-Learning: Definition by GeoLearning

"Covers a wide set of applications and processes such as Web-based learning, computer-based learning, virtual classrooms, and digital collaboration."

It includes the delivery of content via Internet, intranet/extranet (LAN/WAN), audio/video tape, satellite broadcast, interactive TV, and CD-ROM.

source: http://www.geolearning.com

e-Learning: Definition by GI

„All aspects of computer-assisted learning“

source: German Society of Informatics, E-Learning group

e-Learning: Definition and characteristics by University of Heidelberg in cooperation with MIT

„ Learn 365 days / 24 hours – place and time-independent

Centerd on the learner, individual learning

e-Learning (alias Online-Learning or Web-based Teaching) is characterised by the fusion of education and internet, whereby offer and transfer of knowledge is realized with the employment of modern technology.“

- The learning environment is based on internet services like WWW and eMail as primary modi for communication and presentation.
- Learner and teacher can be separated in place and/or time, whereby the communication between both can be synchronous (chat) and/or asynchronous (eMail, bulletinboard, etc.). Learning processes should be activated, managed and supported by this means.
- Main parts of such online learn environments are:
  - Content: text, pictures, animations, audio, video, …
  - Communication tools: e-mail, bulletinboard, Chat, …

source: University of Heidelberg http://www.elearning.uni-hd.de/index.shtml#elearning

Advantages of e-learning

- Access to course content is not temporary or regional restricted
- Dynamic and up to date content
- Content can be arbitrarily fitted in a network
- Interaction with teachers and other learners are possible
- Capable of being extended
- Tracking of performance and learning results
- Adaptation to a individual learn style and speed
- Standard hardware and software on userside

source: University of Heidelberg http://www.elearning.uni-hd.de/index.shtml#elearning

… Based Training – Definitions by GeoLearning

- **Technology-Based Training:** Includes the delivery of content via Internet, intranet/extranet (LAN/WAN), satellite broadcast, audio/video tape, interactive TV, and CD-ROM. Technology-based training includes computer-based training (CBT) and Web-based training (WBT).
- **Computer-Based Training (CBT):** Course or educational material presented on a computer, primarily via CDROM or floppy disk. Unlike Web-based training, computer-based training does not require a computer connected to a network and does typically not provide links to learning resources outside of the course.
- **Internet-Based Training/Web-Based Training (WBT)/Online Training:** Delivery of educational content via a Web browser over the public Internet, a private intranet, or an extranet (LAN/WAN). Internet-based training provides links to learning resources outside of the course, such as references, e-mail, bulletin boards, and discussion groups. It provides the advantages of computer-based training (CBT) while retaining advantages of instructor-led training. The term Internet-based training is used synonymously with Web-based training and online training.

source: http://www.geolearning.com

LCMS – LMS
Definitions by GeoLearning

- **Learning Content Management System (LCMS):** A software application (or set of applications) that manages the creation, storage, linkage, use, and reuse of learning content. LCMSs often store content in granular forms such as learning objects.
- **Learning Management System (LMS):** Internet-based software that deploys, manages, tracks and reports on interaction between a) the learner and the content, and b) the learner and the instructor. In particular, training management systems perform student registration, track learner progress, record test scores, and indicate course completions, and finally allow instructors/trainers to assess the performance of their students. Learning management systems administer and track both online and classroom-based learning events, as well as other training processes.

source: http://www.geolearning.com

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Learning object: Definition by IEEE

" A learning object is defined as any entity, digital or non-digital, that may be used for learning, education or training."

source: IEEE Draft Standard for Learning Object Metadata

Learning object: Definition by GeoLearning

Learning object: A reusable, media-independent collection of information used as a modular building block for e-learning content. Learning objects are most effective when organized by a meta data classification system and stored in a data repository such as an LCMS.

source: http://www.geolearning.com

Learning object: Definition by Wiley

"Learning objects are defined here as

- any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning.
- Examples of technology-supported learning include computerbased training systems, interactive learning environments, intelligent computer-aided instruction systems, distance learning systems, and collaborative learning environments.
- Examples of Learning Objects include multimedia content, instructional content, learning objectives, instructional software and software tools, and persons, organizations, or events referenced during technology supported learning."

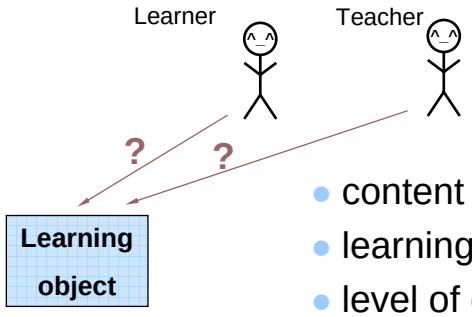
(LOM 2000; cited after Wiley, D.A. (2000). Connecting learning objects to instructional design theory: A definition, a metaphor, and a taxonomy. In D.A. Wiley (Ed.), The Instructional Use of Learning Objects. http://reusability.org/read/)

Learning Objects in the joint course on SE

- Each topic (ppt-file)
- Handouts
- Case studies
- Assignments

Example: Topic01.ppt

Description of learning objects: the problem



- content
- learning goals
- level of difficulty
- context restrictions (time, money, hardware/software, …)
- didactic function
- …

IEEE specification of learning objects: LOM – Learning Object Metadata (60 items)

Data elements describe a learning object and are grouped into *categories*. The Base Scheme (clause 6) consists of nine such categories:

1. The *General* category groups the general information that describes the learning object as a whole.
2. The *Lifecycle* category groups the features related to the history and current state of this learning object and those who have affected this learning object during its evolution.
3. The *Meta-metadata* category groups information about this metadata record itself (rather than the learning object that this record describes) .
4. The *Technical* category groups the technical requirements and characteristics of the learning object.
5. The *Educational* category groups the educational and pedagogic characteristics of the learning object.
6. The *Rights* category groups the intellectual property rights and conditions of use for the learning object.
7. The *Relation* category groups features that define the relationship between this learning object and other targeted learning objects.
8. The *Annotation* category provides comments on the educational use of the learning object and information on when and by whom the comments were created.
9. The *Classification* category describes where this learning object falls within a particular classification system.

Collectively, these categories form the Base Scheme. The last category, Classification, enables an end user to classify a learning object according to arbitrary classification structures. As any classification can be referenced, this category provides for a simple extension mechanism.

source: IEEE Draft Standard for Learning Object Metadata

1. General category elements

1. This category groups the general information that describes this learning object as a whole.

Nr	Name	Explanation
1.1	Identifier	A globally unique label that identifies this learning object. This data element is not and shall not be used, because there is no specified method for the creation of a globally unique identifier.
1.2	Title	Name given to this learning object.
1.3	Catalog Entry	This data element defines an entry within a catalog (i.e. a listing identification system) assigned to this learning object. This sub-category shall describe this learning object according to some known cataloging system so that it may be externally searched for and located according to the methodology of the specified system. This sub-category should be used as a functional replacement for the currently reserved data element 1.1:General.Identifier, as that is currently reserved. NOTE--One of the catalog entries could be generated automatically by a tool.
1.3.1	Catalog	The name of the catalog (i.e. listing identification system).
1.3.2	Entry	Actual string value of the entry within the catalog (i.e. listing identification system).
1.4	Language	The primary human language *or languages* used within this learning object to communicate to the intended user. NOTE--An indexation tool may provide a useful default.
1.5	Description	A textual description of the content of this learning object.
1.6	Keywords	Keywords or phrases describing this learning object. This data element should not be used for characteristics that can be described by other data elements.
1.7	Coverage	The span or extent of such things as time, culture, geography or region that applies to this learning object.
1.8	Structure	Underlying organizational structure of this learning object.
1.9	AggregationLevel	The functional granularity of this learning object.

2. Life cycle category elements

2. This category describes the history and current state of this learning object and those who have affected this learning object during its evolution.

Nr	Name	Explanation
2.1	Version	The edition of this learning object.
2.2	Status	The state or condition of this learning object.
2.3	Contribute	This data element describes those people or organizations that have affected the state of this learning object during its evolution (includes creation, edits and publication). NOTE:--This sub-category is different from 3.3:MetaMetaData.Contribute.
2.3.1	Role	Kind of contribution. At least the Author(s) of the learning object should be described.
2.3.2	Entity	The identification of and information about people or organizations contributing to this learning object, most relevant first. If 2.3.1:LifeCycle.Contribute.Role equals Author, then the entity or entities shall be a person or persons.If 2.3.1:LifeCycle.Contribute.Role equals Publisher, then the entity shall be an organisation. If the entity is an organisation, then it should be a university department, company, agency, institute, etc. under whose auspices the contribution was made.
2.3.3	Date	The date of the contribution.

3. Meta-Metadata category elements

3. This category describes this metadata record itself (rather than the learning object that this record describes). This category describes such things as who created this metadata record, how, when and with what references. This is not the information that describes the learning object itself.

Nr	Name	Explanation
3.1	Identifier	A globally unique label that identifies this metadata record. This is not and shall not be used, as there is no specified method for the creation of a globally unique identifier.
3.2	Catalog Entry	This sub-category defines an entry within a catalog (i.e. listing identification system), given to the metadata instance. This category should describe this metadata instance according to some known cataloging system so that it may be externally searched for and located according to that system. This data element may be used as a functional replacement for the currently reserved data element 3.1:MetaMetaData. Identifier.
3.2.1	Catalog	The name of the Catalog (i.e. listing identification system).
3.2.2	Entry	Actual string value of the entry in the Catalog.
3.3	Contribute	This sub-category describes those people or organizations that have affected the state of this metadata instance during its evolution (includes creator and validator). NOTE: This data element is different from 2.3:Lifecycle.Contribute.
3.3.1	Role	Kind of contribution. Exactly one instance of creator should exist.
3.3.2	Entity	The identification of and information about the people or organizations contributing to this metadata instance, most relevant first.
3.3.3	Date	The date of the contribution.
3.4	Metadata Scheme	The name and version of the authoritative specification used to create this metadata instance. NOTE:--This data element may be user selectable or system generated. If multiple values are provided, then the metadata instance shall conform to multiple metadata schemes.
3.5	Language	Language of this metadata instance. This is the default language for all LangString values in this metadata instance.

4. Technical category elements

4. This category describes the technical requirements and characteristics of this learning object.

Nr	Name	Explanation
4.1	Format	Technical data type(s) of (all the components of) this learning object. This data element shall be used to identify the software needed to access the learning object.
4.2	Size	The size of the digital learning object in bytes. Only the digits '0' through '9' should be used; the unit is bytes, not Mbytes, GB, etc. This data element shall refer to the actual size of this learning object. If the learning object is compressed, then this data element shall refer to the uncompressed size.
4.3	Location	A string that is used to access this learning object. It may be a location (e.g. Universal Resource Locator), or a method that resolves to a location (e.g. Universal Resource Identifier). Preferable Location first. This is where the learning object described by this metadata instance is physically located.
4.4	Requirements	This sub-category describes the technical capabilities required in order to use this learning object. If there are multiple requirements, then all are required, i.e. the logical connector is AND.
4.4.1	Type	The technology required to use this learning object, i.e. hardware, software, network, etc.
4.4.2	Name	Name of the required technology to use this learning object.
4.4.3	Minimum	VersionLowest possible version of the required technology to use this learning object.
4.4.4	Maximum	VersionHighest version of the technology known to support the use of this learning object.
4.5	Installation	RemarksDescription of how to install this learning object.
4.6	Other	Platform RequirementsInformation about other software and hardware requirements.
4.7	Duration	Time a continuous learning object takes when played at intended speed. This data element is especially useful for sounds, movies or animations.

5. Educational category elements

5. This category describes the key educational or pedagogic characteristics of this learning object. This is the pedagogical information essential to those involved in achieving a quality learning experience. The audience for this metadata includes teachers, managers, authors and learners.

Nr	Name	Explanation
5.1	InteractivityType	The flow of interaction between this learning object and the intended user. In an expositive learning object, the information flows mainly from this learning object to the learner. Expositive documents are typically used for learning- by- reading. In an active learning object, information also flows from the learner to this learning object. Active documents are typically used for learning- by- doing. Activating links to navigate in hypertext documents is not considered as an information flow. Thus, hypertext documents are expositive.
5.2	LearningResType	Specific kind of learning object, most dominant kind first.
5.3	InteractivityLevel	The degree of interactivity between the end user and this learning object.
5.4	SemanticDensity	Amount of information conveyed by this learning object as compared to its size or duration.
5.5	IntendedEndUserRole	Principal user(s) for which this learning object was designed, most dominant first. A learner works with a learning object in order to learn something. An author creates or publishes a learning object. A manager manages the delivery of this learning object, e.g., a university or college. The document for a manager is typically a curriculum.A typical example of a learning object whose intended end user is an author is an authoring tool, specifically an authoring tool for learning objects, like a questionnaire authoring tool, or a pedagogical simulation authoring tool.
5.6	Context	The principal environment within which the learning and use of this learning object is intended to take place.
5.7	TypicalAgeRange	Age of the typical intended user. This data element shall refer to developmental age, if that would be different from chronological age.
5.8	Difficulty	This data element defines how hard it is to work through this learning object for the typical target audience.
5.9	TypicalLearningTime	Approximate or typical time it takes to work with this learning object.
5.10	Description	Comments on how this learning object is to be used.
5.11	Language	The human language used by the typical intended user of this learning object.NOTE:--As an example, for a learning object in French, intended for English speaking students, the value of 1.4:General.Language will be French, and the value of 5.11:Educational.Language will be English.

6. Rights category elements

6. This category describes the intellectual property rights and conditions of use for this learning object. NOTE:--The intent is to reuse results of ongoing work in the Intellectual Property Right and e-commerce communities. This category currently provides the absolute minimum level of detail only.

Nr	Name	Explanation
6.1	Cost	Whether use of this learning object requires payment.
6.2	Copyright	Whether copyright or other restrictions apply to the use of this learning object.
6.3	Description	Comments on the conditions of use of this learning object.

7. Relation category elements

7. This category defines the relationship between this learning object and other learning objects, if any. To define multiple relationships there may be multiple instances of this category. If there is more than one target learning object, then each target is covered by a new relationship instance.

Nr	Name	Explanation
7.1	Kind	Nature of the relationship between this learning object and the target learning object, identified by 7.2:Relation.Resource.
7.2	Resource	The target learning object that this relationship references.
7.2.1	IdentifierUnique	Identifier of the target learning object. This is not and shall not be used.
7.2.2	Description	Description of the target learning object.
7.2.3	Catalog Entry	See 1.3:General.CatalogEntry.

8. Annotation category elements

8 This category provides comments on the educational use of this learning object, and information on when and by whom the comments were created. When multiple annotations are needed, multiple instances of this category may be used.This category enables educators to share their assessments of learning objects, suggestions for use.

Nr	Name	Explanation
8.1	Person	The person who created this annotation.
8.2	Date	Date that this annotation was created.
8.3	Description	The content of this annotation.

9. Classification category elements

9. This category describes where this learning object falls within a particular classification system. To define multiple classifications, there may be multiple instances of this category.

Nr	Name	Explanation
9.1	Purpose	The purpose of classifying this learning object.
9.2	Taxon Path	This sub-category describes a taxonomic path in a specific classification system. Each succeeding level is a refinement in the definition of the higher level. There may be different paths, in the same or different classifications, which describe the same characteristic.
9.2.1	Source	The name of the classification system. This data element may use any recognized "official" taxonomy or any user-defined.
9.2.2	Taxon	This sub-category describes a particular term within a taxonomy. A taxon is a node that has a defined label or term. A taxon may also have an alphanumeric designation or identifier for standardized reference. Either or both the label and the entry may be used to designate a particular taxon. An ordered list of taxons creates a taxonomic path, i.e. "taxonomic stairway": this is a path from a more general to more specific entry in a classification.A TaxonPath shall have a depth from 1 to 9. Normal values should be defined as values between 2 and 4.
9.2.2.1	Id	The identifier of the taxon, such as a number or letter combination provided by the source of the taxonomy.
9.2.2.2	Entry	The textual label of the taxon.
9.3	Description	This is the description of the learning object relative to the stated 9.1:Classification. Purpose of this specific classification, such as discipline, idea, skill level, educational objective, etc.
9.4	Keywords	These are the keywords and phrases descriptive of the learning object relative to the stated 9.1:Classification. Purpose of this specific classification, such as accessibility, security level, etc., most relevant first.

Some example entrys for our course (1)

1. General information

Nr	Name	Entry
1.2	Title	("en","Topic 1 – What is Software Engineering?")
1.3	Language	"en"
1.4	Description	("en","The goal of this introductory topic is to give - a motivation for dealing with SE - a description of subfields of SE - a definition (several definitions) of SE - practice problems originating in complex software - an overview of this course (literature, history).")
1.5	Keywords	Software Engineering, Motivation,Definition, History
1.8	Structure	linear
1.9	AggregationLevel	2

2. Life cycle

Nr	Name	Entry
2.1	Version	("en","Apr. 16, 2003 (D Apr. 16, 2003)")
2.2	Status	final
2.3.1	Role	author
2.3.2	Entity	vCard of K.Bothe
2.3.3	Date	"2003-04-16"

Syllabus

Topic 1: Lecture Notes (instructions for the lecturer)

Author of the topic: Klaus Bothe (Berlin)
English version: Klaus Bothe (Berlin)
Author of the lecture notes: Klaus Bothe (Berlin), 14th Nov 2002

About the subject of this topic:

The goal of this introductory topic is to give
- a motivation for dealing with SE
- a description of subfields of SE
- a definition (several definitions) of SE
- practice problems originating in complex software
- an overview of this course (literature, history of SE ...)
…

Some example entrys for our course (2)

4. Technical Information

Nr	Name	Entry
4.1	Format	“application/ppt”
4.2	Size (in bytes)	“3.584.512”
4.3	Location	“http://www.informatik.hu-berlin.de/...”
4.4.1	Type	operating system
4.4.2	Name	multi-os

5. Educational Information

Nr	Name	Entry
5.1	InteractivityType	expositive
5.2	LearningResType	lecture
5.3	InteractivityLevel	low
5.4	SemanticDensity	low
5.5	IntendedEndUserRole	teacher, learner
5.6	Context	higher education
5.7	TypicalAgeRange	“18-”
5.8	Difficulty	easy
5.9	TypicalLearningTime	“PT1H40M”
5.10	Description	(“en”,” Lecturers notes”)
5.11	Language	“en”

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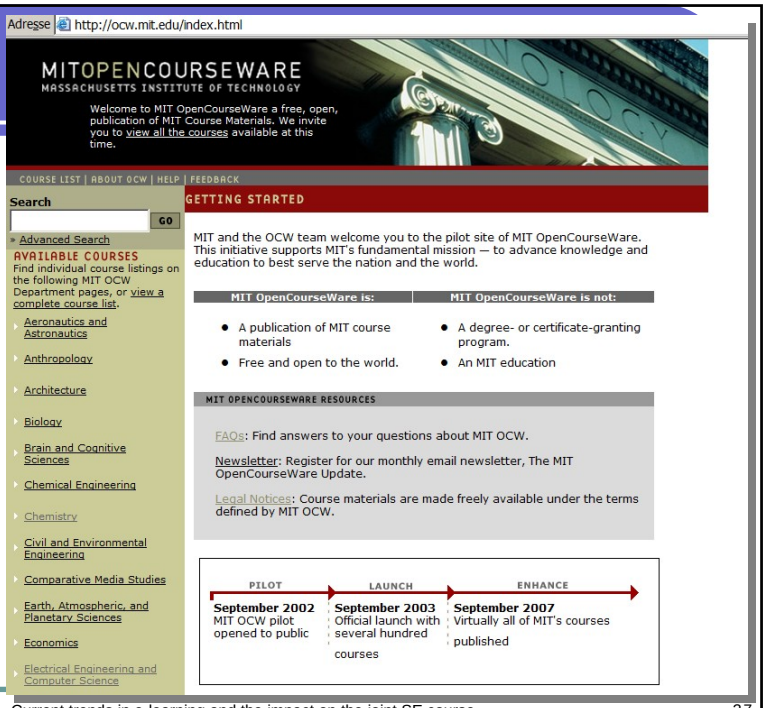
Homepage for
MIT Open Courseware



What is MIT OpenCourseWare?

"Because MIT OCW is not a distance-learning, or a degree-granting, initiative, there is no registration process required for users to view course materials. MIT OCW is a publication of the course materials that support the dynamic classroom interactions of an MIT education. MIT OCW is available on the Web, free of charge, to any user anywhere in the world."

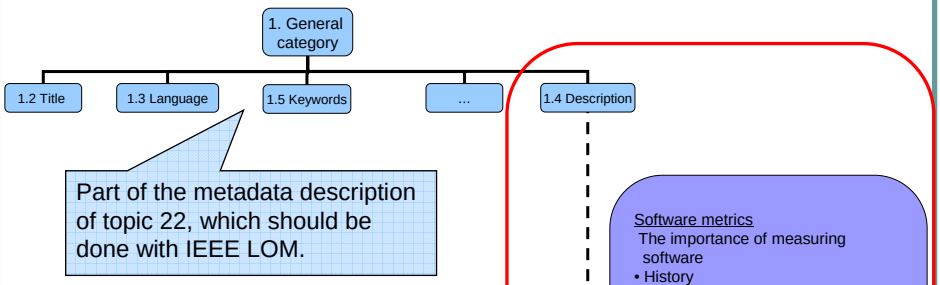
"The idea behind MIT OpenCourseWare (OCW) is to make MIT course materials that are used in the teaching of almost all undergraduate and graduate subjects available on the Web, free of charge, to any user anywhere in the world. MIT OCW will advance technology-enhanced education at MIT, and will serve as a model for university dissemination of knowledge in the Internet age. This venture continues the tradition at MIT, and in American higher education, of open dissemination of educational materials, philosophy, and modes of thought, and will help lead to fundamental changes in the way colleges and universities utilize the Web as a vehicle for education."

source: http://ocw.mit.edu

MIT OCW Development and Publishing Plan

	Discover/Build AY2002-2003	Publish/Expand AY2003-04 through AY2004-05	Enhance AY2005-06 through AY2006-07
MIT OCW scope	• Pilot version • Representative sample courses from all five MIT schools • Representative formats: lecture notes, video lectures, simulations, lab courses, more	• Production version • Hundreds of courses • One or more complete curriculum tracks • Enhanced search via metadata tags • OKI compliance	• Near-full coverage of MIT curriculum (~2,000 courses) • Regular update and refresh of all course materials
Content collection and publication processes	• Handcrafted/custom built Web sites • Experimentation with: - content harvesting from existing MIT sources - copyright clearance process • Metadata strategy	• More uniform/more automated processes based on content mgmt tools • Metadata tagging implementation	• Production-level publishing operation
Technology	• Temporary approach based on: - HTML - standalone course sites - manual coding • Implementation of longer term scalable infrastructure	• XML • Content mgmt tools • Integration with related MIT learning management systems • OKI compliance	• Full-featured content management and publication production system
Evaluation	• Basic usage statistics • Usability test data	• User profile data • Information on used modes and methods	• Impact of MIT OCW
Impact and benefits	• Introduction to concept and character of MIT OCW • Improvement in quality for some MIT course materials	• Viable resource for adoption of courses/ curricula by others • New service for MIT faculty in facilitation of course material development.	• Dissemination of accumulated knowledge on best pedagogical practices based on user feedback • Benchmark for curriculum content • Model for sharing courseware at other institutions • Deeper, richer content and more consistent features, look and feel among courses • Permanent archive of course materials

Problems of content description – example topic 22

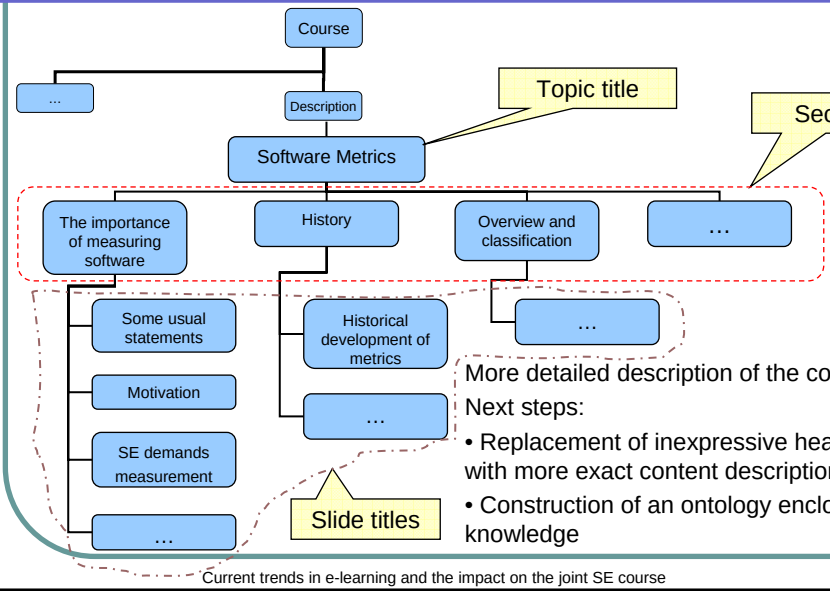


Problems:

- Content not very well structured and searchable.
- No fine granular access or desciption of specific subjects.

Software metrics
The importance of measuring software
- History
- Overview and classification
- Cyclomatic complexity
- Halstead metrics
- LOC metrics
- Style metrics
- Object-oriented metrics
- McCabe testing toolset (CAME-Tools)
- Evaluation of techniques
- A realistic example (CS-L)

Possible extended contents description – example topic 22



More detailed description of the contents.

Next steps:

- Replacement of inexpressive headlines with more exact content description.
- Construction of an ontology enclosing all knowledge

Use of the metadata description

- Generate a description like the www.SWENET.org module description for each topic from the meta-data (automatical)
- Use the ontology in a program or extentional websides as basis for an associative navigation structure for search and self-study for the students and other interested people or in a LMS (section 5. Navigation)

What is Software Engineering?

Module	ISE1 - Overview of Software Engineering: What is Software Engineering?	
Version	Version 0.1 - 8/7/02	
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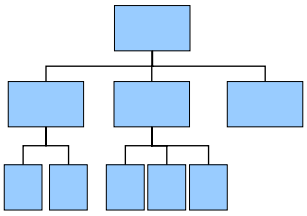
SWEBOK Areas	Software Requirements (RE, RA, RS) Software Design (BC) Software Testing (BC) Software Maintenance (BC)	
SEEK Areas	REQ.fd DES.con CON VAV.fnd EVO.pro.1	Requirements Fundamentals Software Design Concepts Construction (introduction only) V&V terminology and foundations Basic concepts of evolution and maintenance
Prerequisite Knowledge	Although there is no specific prerequisite knowledge, it would be helpful if students were taking or had completed an introductory programming class.	
Abstract	This module is designed to introduce the discipline of software engineering to students new to computing. Through reading, research, reporting and class discussion, students learn about the discipline - its content, its major problems, its goals, and the principal activities of software engineers.	
Size	Lecture: 60 min Exercise: 3 hours	
Learning Objectives	**Bloom Level**	**Educational Objective**
	Knowledge	Define the term "software engineering".
	Knowledge	Describe the problems in software system development and evolution.
	Knowledge	Identify the activities associated with software engineering as applied in the development of a software system.
Topics	1. What is software engineering? 2. What are the problems with software development and why is it so hard? 3. What do software engineers do? 4. How does software engineering differ from basic programming?	
Module Materials	1. Teaching tips for the ISE1 module (MS/Word) (PDF) 2. OSE1 exercise booklet (MS/Word) (PDF) 3. Key to OSE1 exercise (MS/Word) (PDF)	
Resources & References	1. http://www.sei.cmu.edu/about/overview/whatis.html 2. http://www.omse.org/whatis.htm 3. http://www.gamasutra.com/features/19991216/mcconnell_pfv.htm 4. http://www.bls.gov/oco/ocos267.htm 5. http://www.swebok.org/ 6. Gibbs, W. "Software's Chronic Crisis." *Scientific American* 271, 3 (September 1994): 86-95. 7. Bourque P. and Dupuis R., eds. *Guide to the Software Engineering Body of Knowledge*, IEEE CS Press, Los Alamitos, Calif., 2001.	
Author Comments	This module is designed for use with first year students in computing (computer engineering, computer science, information systems, information technology, software engineering). It could also be used in a high school programming course to introduce the software engineering discipline.	

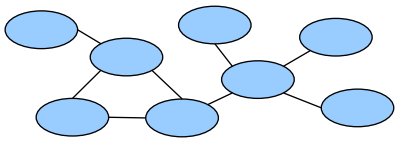
Agenda

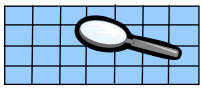
1. E-learning conferences and their subjects
2. Definitions in the field of e-learning
3. Learning objects and their specification
4. MIT open courseware (Semantic Web)
5. Navigation (logic or associative) and search in course material
6. Summary and conclusions

Possibilities of presenting contents and navigation in e-Learning environments

- Hierarchical navigation structure like a book or our course:
  - Book (course), chapters (topics) , sections (parts in topic), subsections (slide), content
  - Guided learning like in a normal class
- Logical or associative navigation structure:
  - Linked subjects (like in a ontology)
  - Search in existing metadata
- Lexical navigation structure:
  - Lexical search
  - Keywords, index



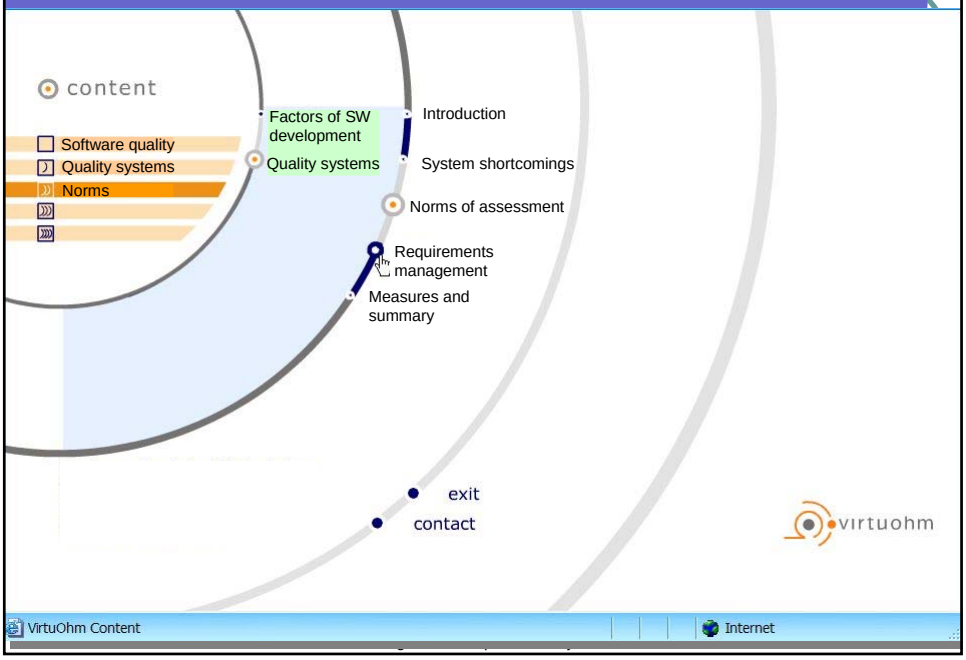




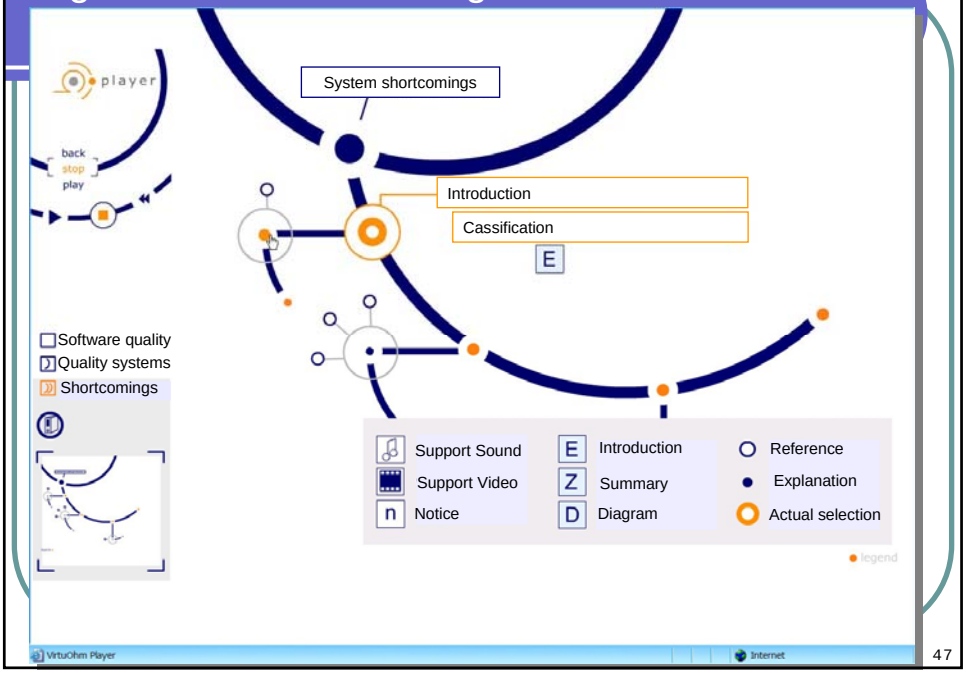
The example of the VirtuOhm LMS

- Virtual learning environment
- Developer: Georg-Simon-Ohm-Fachhochschule Nürnberg
- Source: SEUH 8, “VirtuOhm – Konzept einer virtuellen Lernumgebung”, Prof. Hans Georg Hopf
- www.VirtuOhm.de

Hierarchical navigation



Logical / associative navigation



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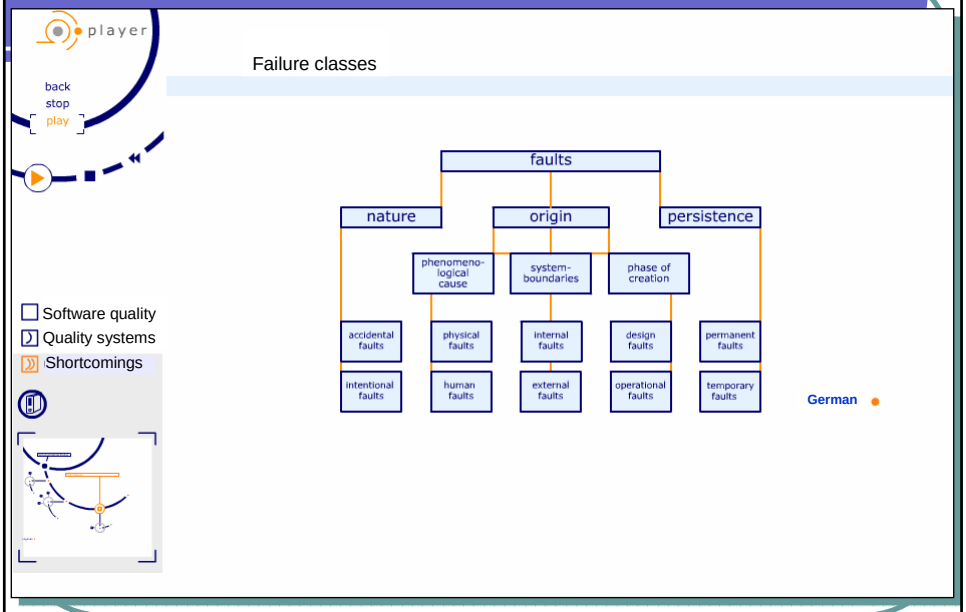
Content representation



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Summary: advantages of using learning object metadata desciptions

- Reuseability
  - Contents can be used in various applications
  - Other authors can adapt contents
- Access
  - Independent from place, time and source
- Search and navigation
  - More exact query results
  - Support of self-study
- Interoperability
  - Different platforms can cooperate with other systems and author tools

Possible research directions in our project

- Use of metadata
  - Usage of LOM for topic and course description
  - Building an ontology for each topic / the whole course
- LMS for our course
  - Representation
  - Search in contents
- Content development support
- Translation support (multilinguality)