Teaching and Learning Environments in Physics

Christian B. Lang

Inst. f. Physik / Theoretische Physik
Karl-Franzens Universität Graz
Plan of the talk

1. What is an LMS?
   - The path to e-teaching/e-learning environments
   - Short survey of e-education platforms
   - Physics application examples

2. What can you do with an LMS?
   - Teaching/learning concepts
   - Content, communication, collaboration

3. What is my own experience?
   - Sample courses
   - How to start, how to use
   - Should you use it at all?
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What is an LMS?

Teaching and Learning with Web-based integrated “Multimedia” environment:

“Lehr-Lern Plattform”

Teaching and Learning Environment (TLE)
Electronic Education Environment (EEE)

Learning Management System (LMS)
The path to an LMS

Lecture notes, Book, CD

Web

Homepage, link-list, “multimedia” material, interactive tools

E-mail, peer-to-peer communication, administration

Learning Management System
Learning Management System

- **Content**
  (e.g. lecture notes, supporting material, web-tools)

- **Communication**
  (e.g. e-mail, chat, workspace, forum, comments)

- **Administration**
  (student/group management, authentication, filespace etc.)

- **Other tools**
  (e.g. students publishing, homework servers, mathservers, evaluation etc.)

- **Learning organisation**
  (e.g. workspace, student’s desktop)

- **Evaluation**
  (e.g. course, exams, grading)
Server based, therefore:

- Centrally updated „living content“
- Standard software (browser client)
- Communication & new collaborative tools
- All-in-one solution
- Simple authorization
- Anytime - Anywhere - Anybody
Contra LMS

- Extra managing overhead
- Usual (technical) e-education problems
- Personal contact cannot be substituted by e-media!
- Dependence on sysadmins
- Too many LMS-types
- $$$
- . . . . .
Features (1)

• Content publication of Web-accessible documents
  - Organisation of content documents (linking, tracking, managing)
  - Authoring tools
  - Content tracking
  - Standardization properties (SCORM 1.2; Metadata standards)
  - Type of documents (depending on users' browser details, plugins etc.)
    HTML, (XML, XHTML, MathML; scripting languages for dynamic html), (POSTSCRIPT) pdf, Jpeg (gif), mpeg, quicktime, Java (applets)
  - Student-dependent content modules
  - Evolving “living” content
  - Lecture notes to print out
  - Search of contents or other parts of the environment
Features (2)

Communication features

- Forum (asynchronous)
- Newsgroup (asynchronous)
- E-mail (asynchronous)
- Shared workspace for students and groups (asynchronous)
- Chatbox (synchronous)
- Whiteboard (synchronous)

Student contributions and support

- Publish contributions
- Add comments to contents
- Personal desktop
- Individual study plan / learning flow management
- Collaboration in a group
Features (3)

• Exercises
  
  Support in setting up exercises
  Self tests
  Quiz
  Graded tests (mainly multiple choice type)
  Feedback concerning progress
  Compatibility/Connectivity with other exercise/homework servers (cf. utexas)

• Adding external program interfaces
  
  Java applets cf. html
  Java interfaces to other applications (e.g. MATHEMATICA/Maple)
  Other tools (dedicated programs or hardware in experiments)
Features (4)

- Course management
  - Registration and accounting
  - Authentication (LDAP)
  - Model dependent access rights (teacher, tutor, student...)
  - Group building
  - Tracking of activities
  - Accessing different courses
  - Announcements
  - Calendar
## What is there on the market?

<table>
<thead>
<tr>
<th>Commercial/Proprietary ($$$)</th>
<th>OpenSource / GNU Public License</th>
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<tbody>
<tr>
<td>WebCT/Vista</td>
<td>ILIAS</td>
</tr>
<tr>
<td>Hyperwave eLS (eLearning Suite)</td>
<td>Claroline</td>
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<tr>
<td>Blackboard</td>
<td>LON-CAPA</td>
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<tr>
<td>SumTotal (Docent + Click2Learn)</td>
<td>(Learning Online Network with CAPA)</td>
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<td>+ more</td>
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<td>+ many more</td>
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What is used?

Universities

tend to prefer commercial systems (mainly WebCT), centrally installed and managed, supported by publisher, somewhat less flexible

Departments or individuals

often prefer open source systems, less perfect administration, very flexible

Overall picture: High diversity of LMSs, many of them self-developments

Physicists?

Physicists like to have full control – they often develop autonomous courses and tools.
What is used in physics?

Contents development examples:

- **OpenSource Physics** (e.g. Physlets)
- **CoLoS** (Conceptual Learning in Science)
- **MIT Open Knowledge Initiative / Open Courseware**
- EU: There are dedicated contents development projects, e.g. SUPERCOnductivity Multimedia Educational Tool project is developing learning objects with animations (SCORM compliant)
  (New: **Supercomet2**; cf. [www.supercomet.no](http://www.supercomet.no))
- EU: Projects like **ePhys** for “open learning and teaching in physics”

Contents information/evaluation:

- **MERLOT** (US) : Information/evaluation of Physics SW
- **MPTL**- evaluation activities
- **AKLEON** (Germany) : Information on teaching material
LMS in physics?

- US: Numerous “standard” WebCT courses using publisher provided contents
- Many individual activities with local (self developed) tools and inclusion of content parts, specific tools or functions like physlets available in the Web
- Few LMS applications using collaborative tools

See contributions and talks at this meeting
### (Subjective, biased, personal) suggestion: What LMS to use?

<table>
<thead>
<tr>
<th></th>
<th>Centrally administered system</th>
<th>Locally administered system</th>
<th>Personally administered system</th>
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<tr>
<td><strong>Universities</strong></td>
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Didactics

I am missing also a didactic explanation about how to use in a correct way new technology, but physicists normally don’t like didactics!

Behaviourism

„Basic facts and procedural reaction training“;
tools and skills, standard knowledge and standard problems solving

Cognitivism

„Factual knowledge allows to solve problems“;
contents-oriented, classroom teaching, exercises, problem solving

Constructivism

„Construct your mental picture based on your own experience“;
„situated learning“, Projects, collaborative learning, group building
Stages of learning

Beginner

„does“

observe
imitate
apply

Advanced

„knows how“

understand
decide
act

Expert

„knows“

develop
discover
construct
competence
Content: Structured vs. unstructured

**Structured**
- sequential
- systematic progress
- simple to produce from lecture notes
- simple for making lecture notes

**Unstructured**
- network
- intuitive, expert systems, browsing
- answering questions and solving individual problems
Communication

E-mail
Define the rules (response time, topics)
Beware: It takes your time!!!

Forum (or Newsgroup)
Specify topics or tasks ("build a glossary")
Formulate interesting problems (open problems?)
Do not force your opinion!

Chat
Set regular times
Define the rules
Give the topic in advance (encourage preparing)
Do avoid too big groups (not more than 7)
Moderate the chat
Problem based learning

Collaborative learning

Small groups (3-5)! 

Projects

- Give a task vs. find a task yourself
- Set a tight schedule at the begin!
- Specify the rules
- Wait until asked (do not interfere)
- Results should be published in the LMS (for this course)

Workspace

- Authentication and limits!
- Security?
Things to consider

- Student equipment (extra plugins of extra software)?
- User tracking?
- Grading?
- Motivation? (Behavioristic motivation like in “games” wears off)
- Plan your personal involvement - set limits for yourself!
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Computer and Physics

Introductory course for ~50 first years students with little experience in writing Web-contributions and learning with Web-tools.

Content section:
- Full course script organized as structured set of html+applets+outside links
- Individual student comments to contents (highly used)

Collaborative Activities:
- Individual student projects (voluntary)
- Groups-project: suggestions for self-tests questions
- Forum
- (Chat unsuccessful)

Grading:
30% points for contributions, 70% final written exam
Das nebenstehende Moving Gif stammt von der Seite Granular Hydrodynamics und zeigt das Druck- und Temperaturverhalten beim vertikalen Schüttern einer durch einzelne Teilchen dargestellten Flüssigkeit.

Anmerkungen zu dieser Seite:

Bernadette Köchle (bernadette.koechle@stud.uni-graz.at)
27-Dec-2003 19:04

bei den anwendungsbekannten funktioniert der Link “Simulation der Blutströmung in Herzkranzgefäßen” nicht bzw. man kommt nicht direkt auf die gewünschte Seite. Wenn man vielleicht direkt auf den Link zugreifen konnte, wäre einfacher. Als alternative wäre folgender Link auf dem kann man allerdings nur sehen wie so was ausschaut:
http://www.archiatros.com/forschung.html
(b) Medium size (audience ~30)

Ideal size for LMS with collaborative tools

Quantum mechanics:

Course for advanced 4th semester students
Emphasis on communications and collaboration

Content section:
Few content items, mainly links

Collaborative Activities:
Forum (used)
Group work intense: Three 4-week projects for each group

Grading:
30% for projects, 70% intermediate and final written exams.
QM: Group project

Gruppenarbeit

Hier findet man alles über die Gruppenarbeit und Gruppenprojekte, aber auch die Übungsaufgaben.

- Gruppenübersicht
- Zusammenarbeit zur Gruppenarbeit
- Projekte

WILLKOMMEN

auf der Homepage der Gruppe 4

- Norbert Dorfauer
- Sebastian Gerber
- Gregor Riebisch
- Oliver Huber
- Nina Seehamer
- Jörg Wagner
Here setting up an LMS is not really useful, unless this course is running over several semesters (e.g. long term project) and is also used to build a contents/activities basis.

**Collaborative tools:**

- E-mail for information exchange between classroom meeting
- Students workspace + student contributions for student projects
Conclusion

An LMS allows you to „grow“ your course step by step:

- Start with few contents items
- Use collaborative tools for support
- Add new items during the course or in future courses

Once you have familiarized yourself with the LMS it does facilitate your work!

Standardization is on the way.

(University level: Do we trust each other’s content contributions?)
Thank you for listening!
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<td><a href="http://www.adlnet.org">www.adlnet.org</a> (Advanced Distributed Learning: a DoD initiative)</td>
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