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Title: E-learning excellence - supporting courses and projects

Background

E-learning is a formation of teaching and learning in electronic form through the Internet with the employment of management systems. Classes can be created and be accessible over internet with the help of software that provides classroom features which are referred to as Learning management systems (LMS) or Learning Content Management System (LMCS).

KTH is already using advanced information technology for the benefit of its students and other beneficiaries. When it comes to e-Learning, KTH is using Moodle, which is an Open Source Software and stands for Modular Object-Oriented Dynamic Learning Environment. Most of the components important for pedagogy are handled by Moodle.

Lecturers have full control over their classes and they can benefit from many features that are provided by Moodle such as: forums, journals, quizzes, assignments and resources. All these features can be in closed groups for student and lecturers. Based on Moodle website there are more than 20 customizable activities available to facilitate teaching and learning processes which can be combined in a sequence or grouped for better results.

Existing solution

The following application modules were developed during the initial stage of our project in 2014.

<table>
<thead>
<tr>
<th>Component</th>
<th>Module</th>
<th>Functionality/Feature</th>
</tr>
</thead>
</table>
| Text      | Scientific Editor | · Editor with features to insert Formulae, Scientific Equations and Symbols  
· WYSIWYG implementation               |
| Theory    | Equation Builder | · Equation editor with ready to insert symbols   
· Only limited options will be available in the current version |
| Code Builder | · Automatic python code builder equivalent to the equation supplied  
· Reverse sync after editing the code to the formula  
· Only limited features will be available in the current version |
| Code Run  |               | · Run the automatically generated code by supplying                                  |
parameters/values as per the formula

<table>
<thead>
<tr>
<th>Communication</th>
<th>Peer Instruction</th>
<th>· Enable peer instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment</td>
<td>Question Paper</td>
<td>· Generate question paper for an instance by random selection of questions from a pool of questions</td>
</tr>
<tr>
<td></td>
<td>Peer Review</td>
<td>· Enable peer review</td>
</tr>
</tbody>
</table>

**Further development**

The following possibilities of improvements are prioritized on the below mentioned components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Area of improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedagogy</td>
<td>Extensive improvement of the pedagogy and content development with the help of e-learning tools. Adding all sort of media to pass the knowledge to different type of learners through different educational channels. Mixture of Video, Audio files in combination with text benefit the learners regardless of attendance to the class. Digital archiving to help both lecturers and learners to easily access and manage the educational materials.</td>
</tr>
<tr>
<td>Archive and Question pool</td>
<td>In e-learning platform there are many possibilities to archive learning materials once for each course or each chapter of the course for all participants. This feature can support all sort of file formats as word processing document, sound files, pictures and videos. The platform provides question pool feature for lecturers. This feature helps them to archive all designed questions for quizzes and assignment and system can use it randomly for each student.</td>
</tr>
<tr>
<td>Equation builder/solver (Additional professional tools to support learners)</td>
<td>Editor with features to insert Formulae, Scientific Equations and Symbols with WYSIWYG implementation. Equation editor with ready to insert symbols. Only limited options will be available in the current version. Automatic python code builder equivalent to the equation supplied.</td>
</tr>
<tr>
<td>Communication</td>
<td>Both Lecturer-Student and students-students level of communication will be supported with many tools; feedback forms, forums, virtual students’ corners, group reflection for discussing about each assignment. Examples: Picture number</td>
</tr>
<tr>
<td>Assessment</td>
<td>Assignments can be design and customize in different ways. Assignment,</td>
</tr>
</tbody>
</table>
Development planned for 2015

Work will focus on transferring and enhancing the pedagogy of an existing course with Moodle as platform. We shall integrate different components that combine our modules described above with standard modules from the Moodle library, our aim is to use e-learning features as a support and enhancement of the particular selected MSc-level course at KTH.

This development will be supported by the KTH School for Architecture and the Build Environment (ABE) and coordinated by SEED (Department of Sustainable Development, Environmental Science and Engineering). Two main partners will be involved in the project during 2015.

Department of Computer and Systems Sciences (DSV) at SU with a turnover in 2013 of over SEK 238 million, 223 employees and nearly 7000 students. DSV is Sweden's oldest IT department with extensive knowledge in IT and e-Learning. The Department is leading in four main areas: design for learning, e-government, ICT for developing countries and the art technology. (www.dsv.su)

Teknocord AB is a technology company providing specialized consulting services in the scientific and engineering sector. Teknocord is focused in creating self-sustaining scientific research ecosystems of data and services based on community data and community supported tools. (www.teknocord.com)

Learning Analytic and Data mining
One natural side effect of using online systems for learning and student management is that masses of data are being archived inside them. By analysing these data much interesting and relevant information can be obtained. For example, teachers can evaluate the student performance of the courses vs. usage patterns of the contents to have an understanding about how and in which ways the students used course material and how successful they were. Analysing the usage patterns of different course modules allow course developers to estimate the quality measures of course contents and thereby enhancement of pedagogy. In the popular terms the approach of information retrieval from online learning repositories is referred to as learning analytics. Using learning analytics methods one could also visualize the broad picture of the student enrolment vs performance, make various predictions of outcomes, and provide recommendations for updating institutional policies/and strategies based on student performance analysis, which could contribute to institutional development as well.

We plan to improve the statistical analysis to generate customized reports both for the students and teaching faculty to improve the e-learning experience and making most out of the learning systems. This
helps the students to self-evaluate their position in the processes of learning among the classmates, compared to conventional learning methodology.

**Implementation plan**

1) Interview and requirement analysis form lecturers and learners
2) Design the course structure
3) Digitalize the contents and learning activities
4) Creating the digital archive
5) Create a guide for using the platform and also create a guide or tutorial for how to handle the course.
6) Design and develop contents in additional formats (video production, animation, screen records, pictures and audio files)
7) Implementing the relevant modules for learning, communication and assessment.
8) Registering and enrolling real students in the designed course
9) Improving the modules and processes with the help and feedbacks of involved stakeholders.
10) Closure of the project

The standalone platform with the above modifications is planned to be used in AE2201 Environmental Dynamics/Physical Processes during the Fall semester of 2015.

**Additional system**

SciPro is an online IT-support system for management and supervision of theses at bachelor, master and PhD education levels that is used for several years in DSV. It can manage theses at a whole university, fulfilling administrators’, supervisors’ and students' needs.

SciPro online support of scientific projects unlocks students’ and supervisors’ creativity by reducing administrative steps and providing structure. E-learning systems are meant to be supportive systems for courses and programs which has specific structure and materials. Theses related work however is an individual and topic driven process which cannot be easily supported by standard e-learning platform. SciPro is created to bridging this gap.

**SciPro Goals**

- **Increase** thesis quality and compilations rate
- **Reduce** supervisor’s workload, administration of theses for all
- **Make** students autonomous
- **Manage** large quantities of theses