E-Learning Systems Comparative Analyses

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Abstract: This research paper reports qualitative research studies of e-learning in general concentrating in comparative analyses of e-learning technologies solutions. As more Universities migrate toward e-learning, or upgrade earlier systems, they inevitably face a tough choice in selecting an LMS-Learning Management Systems. Training professionals must choose among a wide array of systems that will form their e-learning infrastructure. The research method was exploratory research to determine the best research design and then empirical research to describe accurately the interaction between the learners and the system being observed based on the previous variables set as important ones. The data were collected throw with literature review of the experts in the field, focus groups and surveys, direct or indirect discussions and in-depth communications, interviews with prospective users. Throw the empirical research we have observed the statistical results, test of reality to provide evidence of suitability and efficacy of the e-learning system as well as its level of usability. We have compared the effective system usage with prescribed scenario. The purpose of the research realized is in order: (1) to determine the best choice for an e-learning management system and make recommendations, (2) to compare two representatives of learning management systems and gather information on distance between learner activities and preconceived scenarios, interactions, intervention strategies and content. In an e-learning environment, information obtained from learner activity contain a certain pedagogical semantic. The observed route of a learner can be used to give feedback information on the effective learning and solution.

1 Learning systems

E-learning is usually defined as interactive learning in which the learning content is available online. Online communication with real people may or may not be involved, but the focus of E-learning is usually more on the learning content than on communication between learners and tutors. Therefore E-learning content plays a core key role in e-learning. Documents and media objects in different formats like text, digital images, video, audio, multimedia presentations, interactive multimedia tutorials, external Web documents including discussion board contributions, various blogs, or wiki-like contributions, discussions forums that are used in the learning process can all be defined as learning content.

Nowadays, there exist a variety of different standards for formatting, structuring, contextualizing, describing meaning and offering functionality for leaning content. Each organization willing to provide learning content needs to conduct a thorough research and analysis of these standards before a decision can be made on how to create and manage learning content. At the next step an appropriate Learning Management System (LMS) or Learning Content Management System (LCMS) supporting the desired standards should be chosen.

LMS is a high-level, strategic solution for planning, delivering, and managing all learning events within an organization, including online, virtual classroom, and instructor-led courses. The focus of an LMS is to manage learners, keeping track of their progress and performance across all types of training activities. It performs heavy-duty administrative tasks, such as reporting to HR (Human Resources) and other systems but isn't generally used to create course content.

In contrast, the focus of an LCMS is on learning content. It gives authors, instructional designers, and subject matter experts the means to create e-learning content more efficiently. The primary business problem an LCMS solves is to create just enough content just in time to meet the needs of individual learners or groups of learners. Rather than developing entire courses and adapting them to multiple audiences, instructional designers create reusable content chunks and make them available to course developers throughout the organization. This eliminates duplicate development efforts and allows for the rapid assembly of customized content.

According to Learning Circuit (2006) LCMS products allow users to create and reuse small units of digital learning content/assets. An LCMS manages the process of creating, storing and delivering learning content. The components of an LCMS are: an authoring application (editors), a learning object repository, a dynamic delivery interface, and administration tools. Though Learning Management Systems and Learning Content Management Systems fundamentally differ in focus, they address complementary aspects of the same high-level goal: to accelerate knowledge transfer. In achieving this goal, they share common ground in three key areas: 1) Content, 2) Users 3) Administration.

LCMS helps create, reuse, locate, deliver, manage, and improve learning content. Content is typically maintained in a centralized content repository in the form of small, self-describing, uniquely identifiable objects, or learning objects, each of which satisfies one or more well-defined learning objectives. Each learning object may have been created from scratch or by re-purposing existing knowledge documents in other formats.

A learning object is a reusable unit of instruction for teaching, typically in e-learning. Garrison et all (2005) defines it as follows: "learning object is a modular digital resource" or more plainly a discrete piece of content that has educational value and is easily transmitted with the flexibility to be used alone or assembled into a more comprehensive learning experience in a variety of contexts". Learning object must have a characteristic that will allow it to be shared, multi-purposed, and repurposed. In order to use a learning object in different contexts or different virtual learning environments, the presentation of the instruction is usually to be separated from the other non-visual content or course metadata. SCORM is and example of this a format. Except for SCORM there are the AICC and IMS standards for content delivery.

There are several research activities and much of a work in this area. Some of the most important are the next ones:

With regard to learning objects and building repositories of learning objects are the next projects: CAREO (Campus Alberta Repository for Educational Objects), BELLE (Broadband Enabled Lifelong Learning Environment), and MERLOT (Multimedia Educational Resource for Learning and Online Teaching).

A new and significant development within the LMS (Learning management systems) world is the introduction of support for distributed content models. Currently, this is a feature offered by ForceTen, an industry-leading LMS from Eedo Knowledgeware (Shaw, S. & Hudson, J., 2004).

The "distributed content model" can be defined, briefly, as follows. Content is distributed across a number of different learning content management environments with their own repositories, each with its own metadata scheme. Using parent-child relationships, these environments are able to share, manipulate and co-ordinate content, while controlling its integrity. For example, Environment A may be able to access certain content in Environment B. Users of environment A would be able, for example, to sequence content from Environment B along with their own content stored in Environment A, and present the result through their own interfaces. However, they would not be able to modify the content from Environment B (unless they used a "save as" mechanism). In a sophisticated strategy, usage of content from outside the native environment could also be tracked via metadata, and then reported for purposes of establishing royalty payments.

The standard definition from a leading industry consulting group: "Distributed content refers to content that lies not only on centralized servers, but also to content which resides on individual computers within an enterprise and to content that resides in other enter enterprises", Acosta et al (2003). In our LCMS context, we are considering content located on one or more servers, which can be shared in highly controlled fashion. Some actors within the general content management industry refer to our distributed model as "modular" content management (Shaw, S. & Hudson, J., 2004).

2 Review of Learning Management Systems

As more Universities and organizations migrate toward e-learning, or upgrade earlier systems, they inevitably face a tough choice. In selecting an LMS-Learning Management Systems training professionals must choose among a wide array of systems that will form the bedrock of their e-learning infrastructure. It's a major commitment. These are large, complex software solutions that are evolving very quickly, they're expensive, and they're very visible to the organization.

Learning Management System (LMS) as a very broadly used term is basically used for determining a wide range of systems organizing and providing access to online learning services for students, teachers, and administrators. These services usually include access control, provision of learning content, communication tools, and administration of user groups. Another term that often is used as a synonym for LMS is "learning platform".

This software package called Learning Management System (or LMS) enables the management and delivery of learning content and resources to students. Most of these popular systems are web-based to facilitate "anytime, anywhere" access to learning content and administration.

Basically, every Learning Management System allows at least for student registration, the delivery and tracking of e-learning courses and content, and testing, and may also allow for the management of instructor-led training classes. However in more well developed and comprehensive systems, one may find tools such as competency management, skills-gap analysis, succession planning, certifications, virtual live classes, and resource allocation (venues, rooms, textbooks, instructors, etc.).

The Learning Management System (LMS) generally manages the delivery of self-paced, e-learning courses. The LMS is able to let people publish courses and place them in an online catalog. Learners who use the system log into the LMS using a browser, and they select courses from the catalog in order to launch them.

The LMS tracks the learners' activities with the courses. The LMS provides online reports for each course and learner. The LMS can be either inexpensive, or completely free for use, and it provides the essential features that we need.

Although the two terms LMS and LCMS seem to be very similar and hard to be distinguished, there is a huge difference between them. The LCMS is the system which stands for "Learning Content Management System", and it facilitates organization of content from authoring tools, and presentation of this content to students via the LMS.

Feature set of a typical LMS (containing the typical tool sets for course website development and management, student and administrator) is:

- Faculty Tool Set for Course Website Development and Management
    - Online grade book
    - Grade reporting tool (i.e. to allow students to view grades)
    - Quiz/Survey development tool
    - Course website backup, download, & upload facilities
    - Student account administration tools
    - Student group administration tools
    - Grader account administration tools
    - Student access tracking (i.e. how many news articles have they posted/read, which pages have they accessed)
    - Webpage access tracking (i.e. how many students have accessed a page, when did each student access the page)
    - Web-based file management
    - Page counters
    - Course website glossary building tool
    - Course website indexing system
    - Course announcements and calendar administration tool
- Students Tool Set
    - Student self-evaluations
    - Student accounts for webpage publishing
    - Group work areas for collaborative webpage publishing
    - Course content annotation facility and bookmarks

- o   Web-based email and discussion groups
- o   Real-time chat rooms
- o   Real-time white boards
- o   Individual grade and progress status reports
- o   Grade distribution status report (i.e. how many students got 90 and above, etc.)
- Administrator Tool Set
  - o   Course website creation, duplication, and deletion
  - o   Course website backups
  - o   Course website downloading and uploading
  - o   Course website statistics
    - ▪ number of students enrolled in a course
    - ▪ number of hits on a course website
    - ▪ file space used by a course website
    - ▪ first and last access date
  - o   Course website student account administration
    - ▪ Batch student account initialization and deletion
    - ▪ Batch course roster

3 Comparative analyses of Learning Management Systems

The most popular and very widely used Learning Management Systems today are: BlackBoard, WebCT, Angel, LAMS, Moodle, Sakai Project, and other less know ones: Desire2Learn, FirstClass, IntraLearn, Jones Knowledge, Manhattan project and many other. Below is given a statistical usage of some popular LMSs in colleges today.

According to Learning Curcuits (2006) the number of organizations using an LMS is still on the rise. Some 86 percent of respondents claim that their organizations used an LMS in 2006, which is an increase of nearly five percent in 2005, up from 81.7 percent.

Also notable was a shift in how organizations are acquiring their learning management systems. A larger number of respondents are opting to host their LMS rather than buy or build, increasing from 11.9 percent of respondents in 2005 to 17.1 percent in 2006.
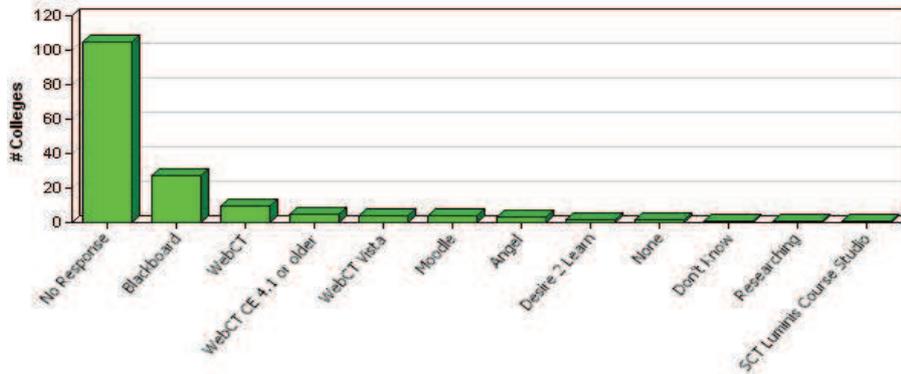
Figure 1. LMS statistical usage, Learning Curcuits (2006)
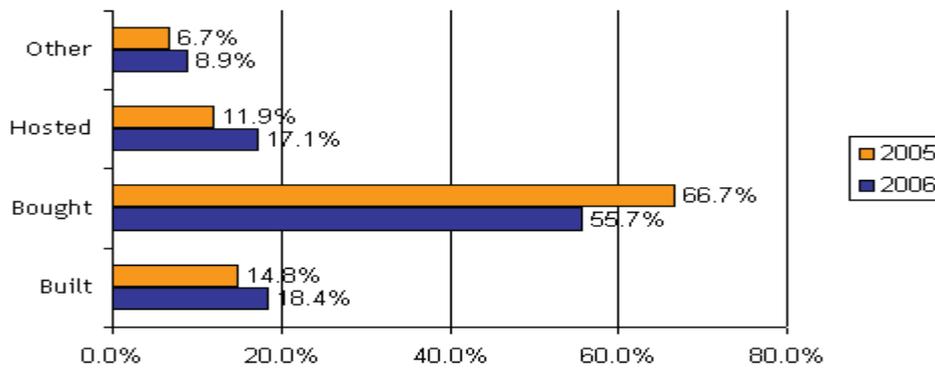
How did your organization acquire its LMS?

Figure 2. Hosting LMS, Learning Curcuits (2006)

Although the majority of respondents (67.7 percent) still state that centralized management of training is their main reason for implementing an LMS, this number decreased considerably from 2005 when the number was 78.6 percent. Other reasons for implementing an LMS, such as measuring training usage or tracking regulatory compliance, continue to lag behind, Learning Curcuits (2006).

To date, Blackboard (www.blackboard.com), WebCT (www.webct.com) and Angel (www.angellearning.com) are among the leading commercial systems. Added together, the client bases of these companies represent thousands of educational enterprises. In addition, there are mixes of campus IT solutions and other projects that have morphed into commercial offerings. One example is ANGEL, the course management system of CyberLearning Labs, today known as Angel Learning (www.angellearning.com) which was developed in the mid-1990s in the CyberLab of Indiana University-Purdue University. Commercial LMS systems have come to require significant investment.

	2006	2005
Centralize management	67.7%	78.6%
Deploy with other systems	7.7%	5.6%
Drive revenue w/in training	13.5%	7.9%
Manage logistics	23.9%	19.8%
Measure costs	6.5%	10.3%
Measure employee performance	22.6%	20.6%
Measure training satisfaction	9.0%	12.7%
Measure training usage	36.1%	29.4%
Track regulatory compliance	32.9%	33.3%
Other	6.5%	7.9%

Table 1. Reasons for implementing an LMS, Learning Curcuits (2006).

There is also an option to use an open source LMS. As with most open source software, however, these systems are not considered as user friendly or easy to manage as their commercial concurrence. Such free Open source LMS to be considered are the Sakai Project (www.sakaiproject.org), Moodle an acronym for Modular Object-Oriented Dynamic Learning Environment (www.moodle.org), other free course management tools include LRN (dotlrn.org), Eledge (eledge.sourceforge.net), Stanford University (getcoursework.stanford.edu) CourseWork, now in version 2.5, was developed by Stanford University Academic Computing as part of the Open Knowledge Initiative, Jones Advisory Group's Jones e-education software, (www.jonesadvisorygroup.com) and many other.

Since LMSs can also restrict the way of delivery of the courses online, it is irreplaceable the freedom that an own solution provides. What differentiates the LMS's from the basic home-made solution is the array of course tools available. However, we can add our own suite of course tools to online courses as we need them, by taking advantage of the large number of free and low-cost internet applications available and this way cater for the specifics of the SEE University needs.

LMSs find it increasingly difficult to support some relevant material because two prominent e-learning content types challenge their value. The first new content type is knowledge chunks. Chunks are small pieces of information that capture individual moments of understanding. Using knowledge chunks as the building blocks of e-learning promotes the convergence of knowledge management and e-learning, as well as effective use of just-in-time learning.

Because so many factors are involved in the decision to select an LMS, the market of the LMS frustrates, making it very hard to compare offers and technology solutions. For example, high-end options don't ensure quality, as well as commercial versus open source or home made solutions provide various range of features, and some low end solutions provide quick and easy-to-install versions that handle basic functionality but don't offer everything the University may need in the future. Adding to the confusion is the high rate of mergers and consolidations as well as the evolving technology within the LMS market.

In continuing to pursue advances in e-learning technologies, however, there are new developments constantly, new objectives, and ends that are redefining the development of the technology and the practice. Whereas e-learning systems initially focused on supporting learning, more recently their development seems headed in quite a different direction, an unexpected direction driven by the necessity for faster and broader communications and knowledge sharing and made practicable by creeping possibilities of technological innovations.

Feature set aside, variables must be weighed in when considering LMS options, and it's anyone's guess how to prioritize them. We have set the following 7 (seven) variables as priority:

- Interoperability: The ease with which an LMS works with third-party content and authoring tools, other database-driven software, synchronous e-learning systems and other software is an obvious concern. Some LMSs only work with their own embedded authoring tools or content that the LMS vendor offers. Considerations should be made to ensure that the LMS supports the latest versions of e-learning standards such as SCORM and AICC.

- Pricing: Insisting on an excellent cost/benefit ratio for the LMS investment is wise; trying to measure best options merely on purchase price is not. The headaches involved in comparing prices of different systems is quite complex. With differing combinations of per-seat pricing, per-use pricing, per-employee pricing, and other models, comparing costs of two or more systems can be exquisitely frustrating. Basically, there are four licensing models now available in the e-learning market:
    1. The software is purchased and installed and managed in-house;
    2. The company buys the software, but it is housed and managed remotely by a third party. Administrators, content builders, instructors and learners access the system over the Internet;
    3. The company buys the software and installs it on its own data platform, but the maintenance and upgrades are managed by the LMS vendor or another third party (e.g., a system integrator);
    4. For the cost-conscious, there is yet a fourth option. Some LMS vendors operating their own enterprise e-learning system offer to share access to their system. Basically, you lease "space" on the host data site.

- Performance: Conducting an up-front performance analysis is crucial if we are to develop the right set of solutions to improve performance. No major training, learning, or performance improvement initiative should be initiated without doing this first. A performance analysis helps determine the exact nature of the performance problem or the performance opportunity. If the analysis shows that you need to develop skills, deliver knowledge or information, or provide support in the workplace, you will be pointed to an appropriate training, workplace learning, or support intervention for your primary set of solutions.

- Content development. Content development encompasses authoring, maintaining, and storing the learning content. This is where the issues of authoring-tool compatibility, version control, and re-usable learning objects are considered.

- Communication tools: Discussion Forums, File Exchange, Internal Email, Online Journal/Notes, Real-time Chat, Video Services and other tools.
- Student Involvement Tools: Groupwork, Self-assessment, Student Community Building, Student Portfolios.
- Evolving technology. The technology used for LMSs has changed extensively in the past years. Some moved from inflexible to more flexible platforms. Mentioning and supporting new evolving technologies is certainly a very important option to bare in mind.

4 Comparative analyses focused on ANGEL & Moodle

From diffusion research we have learned that innovations rely heavily on their acceptability. We have tested several systems but focused primarily on two representatives. One is a representative of the commercial systems - Angel Learning LMS and the other is the open source most popular representative Moodle. In respect of their usability, we will present some comparison analyses of some features based on the previous defined variables. The study was performed within the e-learning project e-learning Frameworks.

4.1 Interoperability Comparison: ANGEL & Moodle

To be interoperable, one should actively be engaged in the ongoing process of ensuring that the systems, procedures and culture of an organisation are managed in such a way as to maximise opportunities for exchange and re-use of information, whether internally or externally Paul Miller (2002)

4.1.1 Moodle Interoperability

There are many dimensions to interoperability for e-learning systems. Moodle's interoperability features include:
- Authentication (using LDAP, Shibboleth, or various other standard methods (e.g. IMAP));
- Enrolment (using IMS Enterprise among other standard methods, or by direct interaction with an external database);
- Quizzes (and quiz questions, using IMS QTI (NB although export works very well, import is currently not complete);
- Resources (using IMS Content Packaging, SCORM, AICC);
- Syndication (Integration with other Content Management Systems such as Postnuke (via third-party extensions).

Also another important feature of the Moodle system is that it has some importing tools, such as importing quizzes or entire courses from Blackboard or WebCT.

4.1.2 Angel Interoperability

According to Data Integration:
Key information about courses, students, faculty, and an enterprise's operation are generally used by several applications. To avoid errors, the LMS must be able to obtain and propagate data automatically.

- ANGEL's data tables are purposely kept very simple to support easy integration with the enterprise SIS and other data systems
- ANGEL tools simplify data integration and perform tasks your way

LAN or WAN Integration:

- ANGEL's API exposes user context information: username, environment rights, course rights, and the unique ID of the active course. This allows integration with LAN or WAN security elements.

Text Import Wizard:

Import data from a text-delimited file into any ANGEL table. Because the wizard does not require a specific file format, it can adapt to any existing systems. Use the Text Import Wizard to import calendar information, process drop/add files, update personnel files.

Database Import Wizard:

Import data directly from any ODBC compliant data source or copy data out of ANGEL into any ODBC compliant database. The wizard's interface attempts to map matching fields between source and destination tables automatically. Once created, script can be reused.

Program Custom Solutions:

Custom solutions can easily be programmed against ANGEL tables. Once written, a SQL stored procedure to process data and import it into ANGEL can be scheduled to perform updates as needed.

Scalability:

ANGEL LMS handles both large and small deployments efficiently and cost effectively:

Accommodates a large number of users with relatively low hardware requirements; smaller institutions can run effectively on a single machine.

Architecture separates major technology layers; implementation can be structured so each component is on a separate server.

ANGEL is intuitive. Beginning users are quickly comfortable using ANGEL's normal mode, decreasing training time.

Users can select beginner, intermediate or advanced modes, allowing beginners to ramp up at their own pace and experienced users to access all the power they need.

4.2 Pricing Comparison: ANGEL & Moodle

ANGEL Learning Inc., formerly CyberLearning Labs Inc., based in Indianapolis, IN, develops and markets ANGEL. The Indiana University Research and Technology Corporation (IURTC), an independent 501(c)3 corporation affiliated with Indiana University, created the company in mid-2000. ANGEL Learning evolved from

research conducted by the CyberLab at the Purdue University School of Engineering and Technology on the Indiana University-Purdue University Indianapolis (IUPUI) campus.

Moodle.org is an open source community launched in 2001 that has grown out of a PhD research project by Martin Dougiamas. Version 1.0 was released on August 20, 2002. Moodle.com is a company launched in 2003 that sponsors Moodle development and provides commercial support, hosting, and custom development and consulting. The Moodle Partners are a network of companies that work with Moodle.com to provide services around the world.

4.3 Performance Comparison: ANGEL & Moodle

ANGEL: Instructors can get reports showing the number of times and time and date on which each student accessed course content, specific course units, discussion forums, assessments, and assignments. Instructors can get a report that shows number of attempts and time per attempt on each assessment for individual students. Instructors can maintain private notes about each student in a secure area. Instructors can get a report that summarizes individual student performance on assignments. Instructors can set a flag on individual course components to track the frequency with which students access those components. Instructors can set up custom reports. Instructors can share tracking information with students. Instructors can get a report displaying the date/time each student accessed a specific course assessment, assignment, or self-assessment. Instructors can view all student folders simultaneously. Administrators can monitor students who are currently logged in to the course. Instructors can summarize all discussion posts to date by group or by student.

Moodle: Instructors can get reports showing the number of times, time, date, frequency and IP address of each student who accessed course content, discussion forums, course assessments, and assignments. Instructors can get a report that shows number of attempts and time per attempt on each assessment for individual students. Instructors can maintain private notes about each student in a secure area. Instructors can get a report that summarizes individual student performance on assignments. Instructors can set a flag on individual course components to track the frequency with which students access those components. Instructors can monitor students who are currently logged in to the course. Instructors can summarize all discussion posts to date by a student.

4.4 Content development Comparison: ANGEL & Moodle

ANGEL: Instructors can selectively release materials, assessments, announcements, and emails based on previous course activity or specific start and end dates. Instructors can personalize access to specific course materials and assessments, based on access rights, group membership, previous course activity, or student performance

and/or specific start and end dates or other criteria. Instructors can set up specific course content that is released on a specific date and that students must complete before they continue with course. Instructors can link discussions to specific dates or course events. Instructors can design courses for instructor facilitated learning or system managed self-study.

Moodle: Instructors can link discussions to specific dates or course events. The system can synchronize course dates defined by the institutional calendar.

4.5 Communication Tools Comparison: ANGEL & Moodle

4.5.1 Discussion forum:

ANGEL: The software includes support for discussion forums. Discussions can be viewed by date, by thread, by title, by author, by group, by the type of post. Students can categorize posts as problems, explanations, scientific explanations, comments, evaluations, or summaries. Instructors can associate a discussion with any course content. Discussions can be shared across courses, departments, or any institutional unit. Instructors may create separate discussion environments for small groups. Groups can be open to all or only a select set of students. Instructors can determine the level of involvement (read, write, or post anonymously) for students. Only the instructor may delete posts. Posts can include attachments, an images or URLs. Posts can be plain text, formatted text or html. The threaded discussion software includes a formatting text editor. Discussion threads are expandable and collapsible to view an entire conversation on one screen. The entire discussion can be saved or printed for off-line reading. Instructors can set up discussion forums so new posts are sent to the email of each student. Students can enable or disable posts to be sent to their email. Instructors can limit discussions to specific time periods. The discussion forums can include a moderation function (screen all posts).

Moodle: The discussion tool supports a social constructionist pedagogy model. Discussions can be viewed by date, by thread, by author. Instructors can split discussion branches from the main discussion into a new discussion. Instructors can determine the level of involvement (read, write, or post anonymously) for students. Posts can include attachments, an image or URL. The discussion tool includes a formatting text editor. Posts may be peer reviewed by other students. Students may receive posts to the discussion forums as daily digests of subject lines or whole posts as email. Students can subscribe to forum RSS feeds.

4.5.2 Calendar/Progress Review:

ANGEL: Students can keep track of all their assignments, deadlines, and due dates in an online calendar. Students can use a course calendar to store private events. Instructors can assign tasks using the online calendar and can post events and announcements in the online course calendar or to the course homepage with an

announcement. Entries in the online course calendar can be posted for the entire class, a specific team, or a specific user. Instructors can link items on a learning objective checklist with the calendar. Students can view their completed and pending course readings and activities. Students can add items to and edit a To-Do list. All students have a personal home page that lists new email, all courses and groups in which the student is enrolled and all course and system-wide events by date, from their personal calendar. Students can view their grades on completed assignments and any instructor feedback total points possible and percentages per gradable item and overall course grade compare their grades against the overall class performance. Calendar entries can be exported in an ical format.

Moodle: Students can view their completed and pending course readings and activities. Students can view their grades on completed assignments. RSS feeds are available for a number of resources that can notify people using aggregators of changes to materials.

4.6 Student involvement tools: ANGEL & Moodle

4.6.1 Self-assessment:

ANGEL: Instructors can create anonymous, timed or untimed self-assessments that students can take multiple times. The system automatically scores multiple choices, true/false, and multiple answer type questions and can display instructor-created feedback and links to relevant course material. Instructors can create a database of questions that the system will randomize to create a unique self-assessment for each student. Instructor may create assessments that route the student to additional assessment, modules, or learning path based on the results of the assessment. Instructors and students can use the MathML equation editor to enter and edit mathematical notations.

Moodle: Instructors can create timed or un-timed self-assessments that students can take multiple times. The system automatically scores multiple choices, true/false and short answer type questions and can display instructor-created feedback, explanations and links to relevant course material.

4.7 Evolving Technologies support: ANGEL & Moodle

Evolving technologies are widely supported by both of the learning management systems. Both e-learning systems support e-learning standards SCORM 2, IMS, and show continual effort to embrace new technologies and identifying and monitoring evolving technologies and their impact on higher education institutions. The first issue concerns legal peer-to-peer and file-sharing networks. The second issue is learning objects. The third issue is the challenge of further integrating the diverse information systems in use at higher education institutions, i. e. libraries, administrative systems, web content and learning management systems.

ANGEL responds to the challenges that academic technologists face in integrating technologies with those that already exist. The only LMS to provide our fully documented database schemas, ANGEL assists technology professionals with an easy answer to the inevitable need to pull or load data directly. And ANGEL API's are not branded or limited, to allow easy integration and extension angel Learning (2006):

- Standard APIs. ANGEL comes standard with fully documented API's that allow you to easily integrate & extend its powerful features.
- Open Schema. No secrets here, we're the only LMS to publish our entire database schema.
- Direct Query. All data stored in ANGEL is accessible via our included SQL query tool or directly via external query. (details)
- Customer Collaboration. ANGEL's priorities are driven via continuous dialog with customers

5 Conclusions

From the diffusion research we have learned that innovations rely heavily on their acceptability. The same happens with digital learning environments. The more learner friendly they are, the more they account for the different criteria of usability, the higher the chance, that learners will use them.

LMSs should be configured, not customized. Selecting customization instead of configurability is another problem. Custom code is an enemy of flexibility, scalability, and efficiency. The LMS should be easily configurable to the strategic business processes and be able to change with them. Hard-coded, one-off customizations require extensive programming from ground zero every time business conditions change.

Paradoxically, free software is not free. The total cost of ownership of open source software is hard to calculate. The lack of formal support mechanisms and the pioneering spirit of open source initiatives require highly skilled, motivated, and creative technical personnel. Embracing a new learning management system has high entry costs because there are few efficient migration tools. Faculty members and educational technology personnel who have invested heavily in one particular system find themselves having to redo much of their work to switch to another one. Academic management must consider learning management systems as strategic systems which should upgraded annually but changed only every five to ten years.

Most systems require one or most of the following resources: educational technology professionals, technical personnel, servers, contract management, training, support, security, and integration. In summary as recommendation, all learning management system optimally should:

- Consolidate training initiatives on a scalable, low-cost Web-based platform,
- Assemble and deliver learning content rapidly in multiple languages.
- Measure the effectiveness of training initiatives.
- Mix classroom and online learning.
- Integrate with other enterprise application solutions.
- Centralize and automate administration.

- Use self-service and self-guided services as much as possible.
- Support portability and standards: AICC, IMS and SCORM.
- Personalize content and enable knowledge re-use.

Regarding the comparative analyses between Angel and Moodle. The fact is that after analyzing both of the systems making a recommendations in favor of any of these systems is difficult and primarily depends on the requirements and the focus of the University or organisation. According to the analysis, some main problems that these two systems contain, and some suggestions how these problems could be solved or recovered are given below:

As we can conclude from the data described above, we can agree that Moodle really has a large number of options that it offers and when these tools come involved into the course they attract the student's attention from his aim. This problem is not faced in ANGEL system, which has a cleaner interface with high usability. As a solution for such a problem, our recommendation is to simplify course pages in the Moodle system, and in this way make it more aesthetic, efficient and attractive. Of course, some necessary tools would have a proper place in a smaller and well readable format.

Another problem of Moodle is that it has a difficult file management. The solution to this problem is allowing managing files and according to the latest news, the professional team of Moodle is currently working on this issue.

ANGEL is not considered to have any problems with the templates and design, but it does not contain a glossary which the Moodle has, and it operates perfectly. I would necessarily put such an item in order to increase its functionality and effectiveness since Moodle is evidence how much it is useful for the learners. Another problem that ANGEL faces is that it does not target a UNIX based system.

All of the above mentioned important issues and problems are the most basic ones that student, instructors and other roles mostly care about. That is why their improvements are important as much as their existence. All of the other tools such as surveys, quizzes, language supports and different options are very functional and efficient in both systems and these items are definitely the ones that I would not change in any of them.

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