

An Open Source LMS Deployment and Integration Strategy for the University of Botswana

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Abstract

Recent developments at the University of Botswana (UB) has proven the university's commitment to transforming to a digital scholarly environment. The implementation of e-learning programme and policy has emerged as one of the strategies to support this initiative. This strategy has led to the rethinking of the role of WebCT, a Learning Management System (LMS) acquired in 2002 to support innovation in teaching and learning, at UB. Since 2002, WebCT at UB has provided students with enrollment services, access to class resources such as teaching and exam timetables, course outlines and past exam papers. The LMS has been well received by staff and students overtime and has allowed a considerable insight into how Virtual Learning Environments (VLE) can be best exploited to enhance teaching and learning. However, due to expensive and inflexible licensing of model of this product, the university is in the process of exploring whether a freely available open source solution, Moodle, can offer similar services. This paper proposes that UB rises to the Moodle popularity

and take up the initiative to integrate Moodle into the teaching and learning operations. We use our experience with Moodle at the Department of Computer Science, together with experiences of other reputable universities, to highlight viability of Moodle and make preparatory recommendations to UB towards Moodle Integration. The recommendations should address issues dealing with UB e-learning policy, cultural technical, pedagogical and administrative transformations relating to the integration of Moodle within UB environment.

Keywords

Open Source Software, E-learning, LMS, Moodle, VLE, Software Deployment and Integration

1. Background

The world's higher educational institutions such as universities are being dramatically reshaped by technological innovations. Recent trends in Information and Communication Technology (ICT) is rapidly changing the way these institutions conduct their teaching, learning and research activities. This has also revealed that the traditional mode of education delivery of chalk and duster is becoming obsolete, and is being replaced by digital methods. Universities now operate learning platforms on which students access course material online which are continually available and therefore promotes the culture of learner centered. It is therefore necessary for university of

Botswana, (UB), to explore teaching and learning that embraces the use of ICT in order to respond to these changing phenomena.

The university has recently approved Learning and Teaching Policy – (Approved by Senate February 20th, 2008)[ref]. One of the Implementation Strategies of the policy is to put into practice strategies, processes and approaches that encourage and facilitate academic staff to integrate the application of appropriate technologies into the teaching and learning processes. In addressing this need, the University of Botswana, (UB) has initiated an E-Learning as a part of the education program, driven by EduTech Department. In 2001 the UB E-Learning (UBeL) programme was established. Its purpose was to transform teaching and learning through the appropriate use of ICTs with a particular focus on e-Learning. Since then a vibrant E-Learning community has emerged at UB, mainly through the guidance of the university's Educational Technology Unit.

To facilitate the E-learning program, UB entered into a licensed contract to use a well known commercial course management system WebCT. WebCT has since provided a relatively reliable environment for the delivery of modern educational concepts via the Internet, though there is currently no binding policy regarding its use besides just the encouragement for staff to use it. However, the university has been bearing WebCT license commercial demands in the past years. There has been also an observation such that there has been structural complexities resulting on over reliance on a commercial products such as WebCT

which are controlled by rigid terms and conditions. As a result, the university is coordinating ventures to assess use of open source course management system (CMS) such as Moodle (Modular Object-Oriented Dynamic Learning Environment), and a possible integration for the use by the whole university. This task is being conducted by the department of Computer Science.

Moodle is a free software E-Learning platform Course Management System. Moodle is an open, flexible e-learning platform which can be specifically tailored to fulfill aspects of a university's E-learning strategy. It has a significant user base of over a million registered users and it can scale from a single-teacher site to a University with 200,000 students [1]. Moodle is spearheaded by the Moodle Company based in Perth, Western Australia and is rapidly gaining market share in the university environments.

It is generally agreed among academics researchers that the significance of open source LMSs can also not be overemphasized. The University has not been spared in being pulled towards the attraction of Moodle as an LMS of choice among academic institutions. For optimal benefits the university must find itself having to prepare for this change.

The main advantage of Moodle is that it brings the solution tailored to user needs, and to integrate with existing procedures and systems. Moodle is noted for its usability and intuitive interface, and it supports various automated personalized services that are easy for faculty and students to access, create, deliver and present. External systems can be integrated easily, to maintain authentication, enrolments and other

things, allowing Moodle to react smoothly as data in other systems is modified. To assist UB in carrying out the Moodle integration we explore possible integration of Moodle and make relevant recommendations.

2. Why Moodle

An E-Learning system potentially impacts the core of a university's activity, and has to be integrated with standard procedures for all the learning and teaching activities including addressing the policy issues relevant to these activities.. As a result the choice of an LMS whether commercial or Open Source, has to incorporate all these issues in its implementation. LMS typically offers a wide variety of tools to make a course more effective and it is a suite tool to enhance teaching by taking advantage of the internet without replacing the need for the teacher [2].

The university market is currently well served by commercial LMS such as Blackboard, WebCT. However, there are other Open Source LMSs which can provide effective solutions to the customer satisfaction problems and provide credible substitutes to commercial counterparts. Other than Moodle, a number of open source LMSs are in existence including those outlined in [3]. Currently there are more than 40 in existence. Moodle is among the most demanded software and is perceived as high value in the education community, particularly higher education and universities. The main advantage of Open Source Software lies in licensing costs usually provided in commercial LMS are eliminated. The second important point is that of the nature of Open Source means that features can be customised and changed to meet the

needs of the user. In addition, Support for Open Source is remarkably powerful [4] despite the myth that it is otherwise. Open source software is usually developed as a public collaboration and the source code is freely available for users to modify and improve. There exist large Open Source communities that are responsible for maintaining and fixing the development needs of the product. This translates to reliable products that have been quality assured by a large team of testers on more technical platforms than a commercial vendor could afford or consider. As a result patches including security patches are released more quickly when vulnerabilities are found, a process which can take weeks or even months in commercial software.

Moodle is gaining popularity among world's universities and is either currently in use or being deployed at a number of world's universities. Several UK universities websites reveal they are in full use of Moodle including Kent, Essex, Bath, Birmingham, Glasgow, Open University and City of Dublin. The biggest of these being Open University, the largest distance learning university in the world. A number of US universities websites such as, Minnesota, University of California, New Mexico and Louisiana State University (LSU) exhibits partial or full deployment towards Moodle. Other universities include, Athabasca Open University and University of Victoria, of Canada, University of Southern Queensland and Curtin University of Technology in Australia and University of Canterbury in New Zealand. A list of institutions using Moodle in the commonwealth region are listed in [6] The list includes regional universities such as University of Cape Town, Monash, UNISA, Kwa-

Zulu Natal and University of the Witwatersrand in South Africa and Polytechnic of Namibia.

Several Universities migrated to Moodle after a thorough evaluation to replace WebCT which UB can learn from. Dublin City University (DCU), [7] adopts an open source (Moodle), over WebCT, under the "Education and Learning" theme of "**Leading Change**" theme which emphasizes '*combining technology-assisted methods with traditional learning methods*'. The main reason for migration is to an open source options was to avoid exposure to "vendor lock-in", a situation where we are dependent on a particular LMS vendor for its products and services and to avoid license price estimated in excess of \$75 000 per annum. DCU Learning Innovation Unit conducted a literature review of the available open source LMSs and identifies Moodle as a 'plausible candidate'. They justify that Moodle includes the core functionality provided by WebCT, along with some useful features and pedagogical tools that are not currently available in other commercial LMSs. They propose a three phased implementation plan, which initially allows a parallel operation with WebCT server with a limited scale deployment moodle, and then moves to retirement of WebCT and migration of all existing WebCT content and users to moodle and finally a full deployment of Moodle. Training. This project will not demand any new funding in the academic year 2003-2004. The plan includes Staff and student training and Technical support and maintenance and estimated costs of deployment.

A report [8] from Centre for the Educational Development and Technology, University of the South

Pacific also outlines how Moodle was introduced to improve teaching and learning based on its 'pedagogical fitness', its overall usability, reliability and functionality and also the extensive adoption of the platform by educational institutions around the world. Integration of Moodle included estimating the costs for the training, infrastructure, monitoring and evaluation, support and building political support. In terms of the choice of infrastructure to support the new integrated LMS, they setup a Moodle LMS server at the main campus. A standalone IBM x3650 eServer with two dual-core Xeon 3.2Ghz processors, 6Gb of memory and four 146GB hard disks. The server runs on Linux Centos with MySQL database and Apache web server.

At another major research university LSU, the Information Technology Strategic (FITS) Plan states that, "***The University must provide a single course management system that responds to the changing needs of the University.*** As a result, a report [9] which explores possible solutions recommends adoption of Moodle through a comparative evaluation survey on features of both commercial and open sources LMS. The report concludes that 'Moodle provides the greatest potential for meeting critical instructional and administrative needs quickly, efficiently, and effectively through local control and administration, while leveraging considerable resources and support from the large Moodle user community'.

In 2007, the Instructional Technology Resource Center (ITRC), Idaho State University produces a report [10] also embarks on finding a replacement for WebCT by evaluating feedback from faculty members, students, support staff,

and assessment officers on the review of WebCT, Sakai, and Moodle LMS software packages. The report also recommends adoption of Moodle. They use criteria such as User concerns and preferences, Ability to support student, Technical and support issues and financial considerations. Overall, after being favored by 'a strong majority', Moodle appeared to offer the most functionality and 'far better positioned to serve ISU's greatest common good over time'. The implementation plan at Idaho State University included training and providing support for faculty interested, a phased migration of courses from WebCT to Moodle, support for a variety of platforms and estimating costs on new hardware needed together with software community support provisions.

WIMBA [11], the education technology company that helps people teach people and a leading provider of collaborative learning software solutions and services to the Higher Education markets also announces an enhanced integration with Moodle [12]. The benefits of the Moodle integration include enabling faculty to incorporate voice recordings with traditional best practices of instruction text-based course content.

3.0 Moodle at Computer Science

The closest experience for UB on Moodle is the pilot project conducted currently at the department of Computer Science which is supported by the EduTech Department. The aim of the pilot project is to explore opensource LMS alternatives to WebCT such as Moodle and Atutor. Computer Science took advantage and immediately launched Moodle on www.cs.ub.bw/moodle in 2005 and urged the staff members to deliver their

course on voluntary bases. Since then the staff interest in using Moodle has been growing up to today where almost all computer science staff members are using Moodle, see Table 1 below.

We look at the preparations, installation and configuration, deployment, maintenance, usage, perception by staff and student, and the evaluation of Moodle at Computer Science

As recommended by the Moodle community, we started by identifying technical needs for us to launch Moodle. Like most open source packages, Moodle requires Linux, Apache web server, MySQL database, and PHP which are luckily open source tools too. We installed all these in a Sun Server V240 with 4X70GB hard drives. This server is housed by the department and has internationally accessible IP address and URL. That way staff and students can access this server from anywhere in the world.

The main concerns of Moodle is how much load it handle in terms of number of registered users and maximum of concurrent users. These may depend on the other players other than Moodle itself such as the server (Apache), RAM, MySQL. However general capacity capabilities of Moodle are 1) browsing users: the maximum number of users able to browse your Moodle site. This is the number of computers in your organization or on your course (whichever is greater).

2) Concurrent database users: the maximum number of concurrent database users (needed for Moodle activities such as quizzes). This is the number of users who will be using Moodle at the same time. In an

educational institution, use your timetable/roster to obtain this figure.

The general rule of thumb for a single server is that the approx max concurrent users = RAM (GB) * 50 and the approx max browsing users = Approx max concurrent users * 5. As an example, a university with 500 total computers on campus and 100 concurrent users at any time will need approx 2GB of RAM on the one server to support the number of concurrent users [1].

Beyond just looking at a centralized server, there are other clustering techniques that Moodle can be configured for to handle a huge number of users. As a result Moodle can handle large number of users. An example of an institution that has the biggest number of users is UK 'Open University with approximated 500 000 students [5]

The installation is a relatively easy process. After downloading the zipped Moodle package from moodle.org, it was uncompressed into a website accessible directory and was pointed to by www.cs.ub.be/moodle. In that directory there is a configuration file called config.php which was manually edited to connect to the locally installed MySQL database.

The greatest challenge in the Moodle installation was population Moodle with

Generally the statistics show that there is satisfactory interest in Moodle at Computer Science and that Moodle is a viable alternative to WebCT. The following statistical graphs give more details different perspective of Moodle usage at computer science department.

We assessed students' learner-centered attitude toward use of Moodle

Computer Science courses, link the courses to lecturers that they teach, subscribe the appropriate students to their courses. Even though this information is available on the University wide ITS systems there were technical barriers, some of which were licensing issues, in directly connecting our Moodle system to ITS. The only option was to ask the IT services database managers to send us the excel versions of all Computer Science courses details. We then formatted the information into Moodle understandable import files. The login names for students were derived from their surnames and student identity numbers.

As part of the evaluation process, the authors occasionally collect usage statistics both from Moodle internal reports and user survey. We look at the basic statistical analysis that include courses, students, lecturers, forum posts, questions for quizzes and tests and courses posted such as notes and slides. The rate of all these statistical information is worked for per student.

Table 1: Basic Statistics at CS

Courses:	73
Students:	908
Lecturers:	36
Forums posts:	941
Quiz Questions:	443
Online Resources:	1101

Features of 3 LMSs (Atutor, Moodle, and WebCT)

A number of features that we thought were important for the self initiated learning were identified and rated by the respondents. Here we wanted to establish whether Moodle compares well particularly with WebCT regarding the required features for support of student

centered learning. The respondents also answered open ended questions that highlighted the strengths and weaknesses of the three studies CMSs. We then averaged percentages responses for each grading scale, 0, 1, 2, 3, 4, and 5 for each that Moodle as almost as acceptable as WebCT and the reason behind WebCT higher rating is the survey was conducted when Moodle was just introduce and has not totally gained confidence among students.

Figure 2: Rating of ATutor, Moodle and WebCT Features

Reponses indicate that The best performer in supporting student centered learning is WebCT with 67% (26+24+17) of respondents saying it offers either very good or excellent features, ATutor scored 48%(19+16+13) marginally followed by Moodle with 47% (20 + 16 + 11) .

4. Moodle integration at UB

In order to establish whether Moodle should integrate well, UB has to establish what contribution it would provide to enhance the teaching and learning process. We look at specific conditions that may affect UB's the integration of Moodle into it's teaching and learning structures We consider how UB should relate its policies, teaching and learning models and technical issues for the integration of Moodle.

The UB Teaching and Learning policy emphasizes the principle of "*intentional learning*", which puts an emphasis on pedagogical strategies that encourage 'active learning', 'self-directed', and

CMS ATutor, Moodle, and WebCT. The features that we deemed important were the quiz facility, discussion forums, chat forums, interface navigation features, online help facilities, assignment features, email etc. The result indicate

'independent' learners. A contrast to content-oriented teaching strategies that focuses primarily on "covering the material" and passive learning. Students are no longer tied to a programme of lectures with set times and locations; they can acquire knowledge whenever and wherever they choose.

To support this policy issues Moodle is technically designed with features such as, such as forums, live chats, wikis, glossaries, and adding material to the databases, messaging, interface navigation features, online help facilities which allow students to control common content to their satisfaction. Individual blogs allow students to express things in a public but reflective way, often providing access to thinking that might not normally expressed in, say, a forum. All these features encourage students to add to the total course experience by taking part in the way the course is delivered and create representations of their own knowledge and share them with the others. Furthermore Moodle offers advanced features such as live conferencing tool which can provide virtual classroom experience allowing the students to simultaneously view material presented online by the instructor, while interacting with the instructor and other students.

Moodle also offers a platform where all users at any one time can view each other and hence be able to communicate

and learn from each other. Every participants page has a Online Users block which shows a lot of information about who else is on, what activity they how recently they've been there. These activities could include changes to the course and forum posts, reports, assignment submissions and quiz attempts and results from various activities.

Moreover there is usually a big interaction gap between students and lecturers due to accessibility and availability of lecturers which maybe attributed to cultural relationships. One way to improve on this aspect is to deliver content on environment that are more appealing to students such as Virtual Learning Environments(VLE). Moodle can be integrated VLE tools such as [Dim Dim] and [WiZiQ] to create virtual classrooms. Such VLE tools offer environment that enables users to communicate synchronously using video and audio or through text chat, sms technology and to share presentations, documents and images on an interactive whiteboard. Instructors can schedule live-online sessions which get scheduled and listed in the "block", and are automatically listed on the Moodle course calendar. Thus students can easily join their Lecturers live classroom sessions.

The university must also establish if it's IT infrastructure and support are in position to accommodate the Migration to Moodle. UB has a relatively modern ICT infrastructure including an FDDI fiber campus network, about 10 critical universities severs, over 3500 PCs in a population of about 18,000 of both

students and staff. Besides hardware equipment the university is running several critical systems including ITS, WebCT, Staff Email, Student Email, and the UB Website. Further faculties and departments maintain their own localized servers.

Integration of Moodle at UB is possible. The university has already started a pilot project by engaging the Computer Science department and that indicates a plausible interest. The question is how UB can prepare herself for Moodle integration based on Computer Science experiences. The following recommendations are presented as preparatory steps towards possible intergration of Moodle

5 Recommendations

University must embark on a comprehensive evaluation of the impact of its existing LMS,WebCT against open source LMS, Moodle, as an alternative. We have found out, from other universities and our own experiences with the pilot project at Computer Science department, that Moodle is popular and is offering a viable alternative to WebCT.. If Moodle adoption is approved, we make following preparatory recommendations:

Administrative Recommendations

- UB management must provide a clear policy on the adoption and use of Moodle.

- UB must identify relevant university structures and their roles in the procurement and deployment issues leading to integration of Moodle.

To facilitate pedagogical process of Moodle Integration

Change Management

- For easy adaptation by the university community, the integration of Moodle could be done in phased approaches as in Dublin City University and Idaho State University. The university could determine its own phases as relevant to its context.

- The Internet Access must be possible on and off campus.
- Students could be forced to download materials on Moodle portal
- A reward system in terms a point system could be applied for usage

Technical Recommendations

- Moodle could be integrated into all university strategic plans to enable staff to develop interest in it. Academic staff could be motivated to develop the culture of using Moodle as a teaching delivery tool.
- Performance Management System (PMS) could be linked to the use of Moodle.
- The internal communication structures such as mailing lists, billboards, newsletters should be utilized to facilitate the Moodle adoption process.

- There should be a dedicated ICT infrastructure put in place for Moodle integration e.g. University of the South Pacific
- There could rooms dedicated for Moodle Access only
- There should be a live connection between existing UB ITS centralized registration system and Moodle such that a student registering on ITS automatically subscribed to the appropriate courses on Moodle.

Software and Hardware needs

Pedagogical Recommendations

Moodle works with a variety of platforms and does not need any modification for cross platform installations. It can run on any hardware that can run the following software tools;

- Linux
 - Moodle runs without modification on Linux
 - Easy License terms
 - Easy development environment (Apache, PHP, MySql, PostgreSQL etc.)
- Windows
 - IIS server, PHP, MySQL, Microsoft SQL Server, Microsoft Access, ADO, and generic ODBC database access,
- Other
 - Mac OS X, NetWare,
 - Oracle, IBM DB2,
 - Borland Interbase,
 - Informix,
 - Visual Foxpro,

Support and Maintenance.

- The technical human capital must be put in place for Moodle deployment. A 24/7 support to all technological software and hardware is recommended.
- The responsibility for sustained customization of Moodle at UB could be charged to an Open Source research and development team. The team would develop, modify and document new features to satisfy the university's specific needs.
- The support system must have the capacity for online status reporting and be capable of keeping track of activities.
- Engagement of students for services in Moodle maintenance could be promoted which would improve student experience and address human resource unavailability.

Training

A systematic training plan that matches the phased based deployment strategy could be put in place

- UB should identify specialized Moodle trainers
- Organize internal training workshops for staff and students

- Funding for training must be made available

6 Conclusion

- UB should identify specialized Moodle trainers

Organize internal

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