Effective E-learning Content Management and Delivery: Multimedia University’s Experience

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Abstract:
Twigg (1993) suggested that “if we anticipate a future when more students need more learning, there is only one way to meet that need without diminishing the quality of students’ learning experiences: We must change the way we deliver education”. It is important for us to experiment with alternate learning technology and delivery systems. We must be bold to implement them, if we were to lead.

Multimedia University is one of the first universities in Malaysia to implement an e-learning solution for its student. The system, which is know as Multimedia Learning System (MMLS), was implemented in 1999 and today the system receives more than 250,000 hits per month. This paper will share Multimedia University’s experience in the implementation of e-learning system as well as content management and delivery. Lessons learnt will be highlighted. Besides Multimedia University’s experience, the paper will also share some of the critical success factors of companies and colleges that have implemented e-learning solutions.
Introduction

“Information and knowledge are the thermonuclear competitive weapons of our time. Knowledge is more valuable and more powerful than natural resources, big factories or fat bankrolls”.

Thomas A. Stewart [1].

In an information age, learning becomes more prominent than ever. Employees must constantly upgrade their knowledge and skills to ensure the competitiveness of their organization. As product life cycles and information life cycles get shorter, the need for training and re-training increases more frequently as well as covering a wider range of employee groups. How do we train more people, more often at a lower cost? E-learning seems to offer the answer.

E-Learning is creating a paradigm shift in the way training and education is viewed and delivered. E-learning brings learning to the employees. Well-designed e-learning environment can provide a mixture of synchronous and asynchronous learning activities. It provides collaboration facilities with experts as well as peers. Digital content can be designed with well known teaching methodologies and instructional models. Digital content can be engaging for the learners with interactive multimedia-rich features. Experiments can be simulated and learning can be fun with game-based learning.

E-learning Market

The e-learning industry has been steadily growing for the last few years. The global e-learning market is expected expand from US$10.3 billion in 2002 to US$83.1 billion by 2006 and US$212 billion by 2011 [3] (http://www.brandon-hall.com). The percentage of corporate companies implementing e-learning solution has increased from 10.5% in 2001 to 25% by end of 2004 (American Society for Training and Development, 4). E-learning grew to a US$23 billion global industry last year with an annual growth rate of 20 percent. Currently there are about 130 million online learners across the world. [Jenna Sweeney, Chief Operating Officer of CramerSweeney Instructional Design]. In Japan, the corporate e-learning market totaled 63.8 billion yen in 2004. This represents a 12% growth against the previous year. By the end of this year, more than half of Canada’s enterprise companies will have an e-learning solution in place, according to IDC
E-learning market can be divided into three segments: content, infrastructure and e-learning services. Content will form the largest market. Currently, content has the slowest growth rate.[8].

**E-learning Market Trends**

Good network environment is vital for the establishment of a good e-learning environment. Sufficient investment must be done on the network infrastructure. Many companies and colleges in Malaysia have done sufficient investment in the network infrastructure. Today, we can say that many of the companies and colleges in Malaysia are network-ready for e-learning.

Another key component need as part of the e-learning infrastructure is the Learning Management System (LMS). LMS market saw a growth of $450m in 2003 and is expected to continue to grow at a rate of 20% per year [9]. Most of the LMS focus primarily on the administration of e-learning. Almost 70% of the large organisations (more than 10,000 employees) in US have adopted or will be adopting a LMS as part of their corporate training programme [9]. For smooth performance of the learning process, it is vital that the LMS are integrated with the ERP or HR systems. If the systems are not integrated, there will be duplication of records/data, thus, will result in inconsistency of the data. Learner administration will become difficult, thus affecting performance. Efforts must be made ensure that the LMS is able to keep track of learners and recommend appropriate modules for the learners based on his or her performance.

The Learning Content Management System (LCMS) was thought to be small market few years ago. However, the LCMS market is immersing big. The developers of LMS are expected to incorporate the LCMS features into their system. We believe that the LMS and LCMS products will be merged and sold as a single product. LCMS will be design to support Subject Matter Experts (SMEs) or other users who need to develop learning objects very easily and quickly. SMEs need not go through long periods of training before they are ready to use the LCMS. For more complex and high quality content development, tools from Macromedia and Microsoft will continue to dominate the market.

Content is king. The content market has been growing slowly of the last few years and it promises a healthy growth over the next few years. ***
The IT-based e-learning content market is very large, estimated to be more than $500m, which is a subset of the IT training market valued at $1.2 billion. IDC believes that the IT Content market will grow by 15% per year for the next few years. Another major content market will be the softskills content. IDC estimates this market to be $1 billion and is expected to grow by 24% per year. Vendors who dominate the content market include NETg, Skillsoft, Serebra and knowledgeNet. The content development market is still open and remains much as a “land for grab”.

Delivery of e-learning materials will adopt the blended approach. Many e-learning implementation in Malaysia have adopted the blended approach.

Another emerging market is the Workflow-based Learning. This approach is really a dynamic way of delivering learning objects to the learners using better search technique that are supported by metadata. Some would term this as real-time or just-in-time learning.

*Figure 1: E-Learning Trends*: Different stages of the e-learning market trends

*Source: Bersin and Associates*
Multimedia University’s Experience

Multimedia University (MMU) was one of the first universities to develop and implement an e-learning system in a campus environment. The first e-learning solution was fully implemented in 1999 when the Multimedia University Cyberjaya campus was established. MMU undertook the development of an e-learning project in 1998. A team of three system analysts started the project. Initial the system was developed using Perl, MySQL and Apache web server. Later, the team size increased to seven system analysts and programmers and the development tools was changed to the Open Source tools such as PHP, MySQL, Apache and Linux.

Content development team was also established. The initial content development team consists of three graphics designers and an Instructional Designer.

At MMU, e-learning is widely used for the distance education as well as for the in-campus learning. All learning materials are made available via the Multimedia Learning System (MMLS), which is a LMS. It is mandatory for lecturers to prepare lecture materials, tutorial and other teaching materials to be made available online via the MMLS system. For the multimedia content, lecturers will be required to prepare the storyboard. Training will be provided for the lecturers on storyboarding. The storyboard need to be reviewed and approved by a committee before content development work could begin. All lecture materials for all the courses must be made available online. 20%-40% of the materials should be supported by multimedia.

In-campus students are expected spend 80% using the face-to-face mode while the remaining 20% using the e-learning mode. These percentages are only a guide and it may vary from subject to subject.

In the case of the distance education or e-learning programmes, students are expected to spend 80% of their time online while the remaining 20% attending face-to-face lectures.
Today, the MMLS receive about 250,000 hits per month per server, indicating wide usage of the system. A summary of the results of a recent survey in the campus has been listed in Appendix A:

Currently, MMLS is in the seventh year of development. Version 5 is expected to be released by the end of this year. Efforts have been made to make the LMS an intelligent LMS (iLMS). The system is capable of delivering learning objects according the ability of learner. Fast learners will be delivered with more challenging content while slow learners will be introduced to simple learning content. MMLS signifies the creation of an intelligent, interactive, self-paced and instructor-led, web-based teaching and learning system.

Figure 2 show the architecture of the MMLS system.

The MMLS system works together with a web server (300) and a database system. Currently the system is integrated with the Apache Web Server and MySQL database. The system can also be integrated with other web servers or database systems.

The MMLS system consists of the following major components:

- Intelligent Agent (100)
- Delivery Agent (200)
The Learner Profile, Learning Competency Records and the Learning Objects are each stored in different database. This will ensure portability of the data to other systems. The Learner Profile database stores information such as tests and quizzes results and other personal data. The Learning Competency stores information such as access time for each Learning Objects, date and time of access, duration of access and frequency of access. The Learning Objects are the courseware materials structured into objects.

There are three databases that stores the above data. The Learner Performance Database (400) has the learners Test, quiz and other academic information. The Learners Tracking Database (500) has the Learners access time, date, time, frequency etc. The Learning Resources (600) has the course content for the learners. As the learner access the MMLS, Learning Competency records are updated. The information collected in these databases are used to monitor and the track the learners. Reports can be generated from the data captured such as time spent on each slide, performance etc. The graphs below show some of the reports that can be generated by the system.

In e-learning, it is easy to measure items such number of courses assigned, number enrolled, number completed and number passed. For each course, we could also determine the number of logins, number of visits per screen, and length per session. In fact, the metrics that can be collected via the MMLS platform is immense. All these measures efficiency but not effectiveness of e-learning. We need metrics to measure effectiveness such as cost, productivity, profitability and learner retention. Without these metrics, we will not be able to understand the impact of e-learning on education.
Kirkpatrick Model

Evaluation of the learning models is important. Kirkpatrick’s model has been a popular model for learning evaluation. In 1997, 67% of the American organization used his model to conduct training evaluations. This model has four levels:

- **Level 1**: Reaction: a measure of learner satisfaction
- **Level 2**: Learning: a measure of learning
- **Level 3**: Behaviour: a measure of behaviour change
- **Level 4**: Results: a measure of results

*Table 1* shows the typical questions you may ask at each level. Can this model be applied to e-learning? Many believe the learning process will be the same even though delivery modes may change. The web is another mode of delivery. People don’t learn differently on the web.

<table>
<thead>
<tr>
<th>Level</th>
<th>Questions</th>
<th>Possible Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaction</td>
<td>• Are the learners satisfied with the course?</td>
<td>“Smile sheet”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Satisfaction (Rating)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Met expectations (Rating)</td>
</tr>
<tr>
<td>Learning</td>
<td>• Did the learner understand?</td>
<td>Pre and post assessment (Grades)</td>
</tr>
<tr>
<td></td>
<td>• Have the skills or knowledge changed?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• How much have they changed</td>
<td></td>
</tr>
<tr>
<td>Behaviour</td>
<td>• Can the learner do it?</td>
<td>Observation (Rating)</td>
</tr>
<tr>
<td></td>
<td>• Has behaviour changed?</td>
<td>Interview (Rating)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evaluation / Performance</td>
</tr>
<tr>
<td>Results</td>
<td>• Does the change in behaviour have an impact on the business?</td>
<td>Increase in orders</td>
</tr>
<tr>
<td></td>
<td>• Do they use it at the job?</td>
<td>Reduce operational cost</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduced absenteeism</td>
</tr>
</tbody>
</table>

*Table 1: Questions for each level in Kirkpatrick Model*

Level 4 is difficult to measure. According to ASTD, most courses are evaluated at level 1 and almost none at level 4.
Laurie Bassi [5] has developed a useful worksheet for comparing classroom learning with e-learning (Table 2).

<table>
<thead>
<tr>
<th></th>
<th>Traditional Learning</th>
<th>E-learning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fixed Cost</td>
<td>Marginal Costs</td>
</tr>
<tr>
<td><strong>Direct Cost</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trainers’ fees</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Outside Vendors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material (Development)</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Material (Production)</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Material (Distribution)</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Hardware</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Software</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Travel Expenses</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Administrative/Support</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Indirect Cost</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learners’ compensation</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Overhead</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Opportunity Cost</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 2: Classroom and e-Learning Cost Comparison Sheet, by Laurie Bassi*  
*(X = Cost may be insignificant)*

Measuring software or digital content has always been difficult. There is no common unit for software or content. In constructing a bridge or building, metrics such as Meter (m), Kilogram (kg), Pascal (pi) and Degree may be used. These units are common to everyone. What is the metrics for software or digital content? In software engineering, kilo-lines-of-code (KLC) or Function Points (FP) are proposed. These units are functions of the programming language, skill and style of writing codes of the programmer and complexity of the program. Thus, these units are not common to everyone.

What are the KPI for e-learning? In order to answer this question, it is necessary to know the impact of e-learning on the company goals. Any investment on e-learning, must show the impact on the company goals. In general, ROI should measure as the increase in financial value provided by the new investment. This definition works well if we are referring to tangible items such as equipment or money. However, it will be difficult to apply to intangible items such as e-learning.
To have a realistic KPI for e-learning, e-learning must incorporate the achievement of university goals. There are three main benefits that can be achieved by e-learning that has an impact of university goals. There are:

- **Performance improvements**
  This can be measured by comparing the achievements (e.g. increase in profit or better performance) of students who have used the MMLS extensively. This method of evaluation is difficult, time consuming and there are many variables that need to be taken into account. A simpler way to measure would be to measure the learner satisfaction (Customer satisfaction). Surveys conducted in the campus indicate that the learners are satisfied with the MMLS (Appendix A).

- **Cost Reduction**
  Content development can be expensive. Thus a cost effective methodology must be adopted to balance cost, quality and time. One approach would be to design content in form of learning objects. These learning objects can be reused or customized for different content. Templates could also be used to improve productivity of content development. MMU has been designing content in the form of objects and templates that could be quickly customized and packaged for different content. The costing of developing learning objects is discussed in the next topic.

- **Improve Quality of Education**
  MMU has always emphasized on quality of the content. While developing good multimedia content can expensive, they can improve presentation and improve student retention level. Students are better able to understand difficult-to-understand concepts easily. Content developed at MMU will need to be reviewed and approved by a committee to ensure that the content meets the minimum standard set.
Courseware Development

The toughest part of e-learning implementation is the content development. Often technology is emphasized rather than content. Most e-learning project have budgeted for the technology but the budget for content development (or purchase) is often forgotten.

Content is now developed in the form of learning objects or SCO, thus increasing the value of content. When content is in standard object format, it becomes sharable, durable, accessible and reusable. This will increase the value of content.

Courseware development costs are largely labour and project management costs. MMU uses cost per Learning Object (LO) or Sharable Content Object (SCO) as the basis for calculation.

The labour cost per hour can be easily calculated in any organization. Example if there is one person working on the content and his/her salary is RM3000 (inclusive of benefits), then cost per hour will be:

\[
\text{Cost per hour} = \frac{3000}{25 \times 8} = \text{RM}15
\]

With the assumption that there are 25 working days in a month with each working day being 8 hours, the cost per hour per designer would be RM15. Normally there is a team of developers are involved and the total cost need to be taken. The team will consist of Subject Matter Expert (SME), Instructional Designers (ID), Graphic Designers (GD), Voice Talent, Video Production, Programmers, Script Editors and Project Management and Administrative.

A typical multimedia SCO may require the following time as shown in table 3. These data are based on the development work done at the Centre for Multimedia Education Development at Multimedia University.


<table>
<thead>
<tr>
<th>Rate per Hour (RM) (Inclusive benefits, calculated based on monthly wages)</th>
<th>Number of hours per SCO (Multimedia)</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>SME</td>
<td>RM30</td>
<td>1</td>
</tr>
<tr>
<td>ID</td>
<td>RM20</td>
<td>1</td>
</tr>
<tr>
<td>GD</td>
<td>RM15</td>
<td>5</td>
</tr>
<tr>
<td>Voice talent/Editing</td>
<td>RM15</td>
<td>1</td>
</tr>
<tr>
<td>Programmer</td>
<td>RM20</td>
<td>2</td>
</tr>
<tr>
<td>Script Editor</td>
<td>RM20</td>
<td>0.5</td>
</tr>
<tr>
<td>Project Management/Admin.</td>
<td>RM40</td>
<td>0.5</td>
</tr>
</tbody>
</table>

| Cost per SCO | 11 | RM210 |

**Table 3: Cost of Developing a Multimedia SCO**

On the average one hour of classroom instruction will translate to about 20 minutes of e-learning. Normally 20 SCO are needed to make up one hour of e-learning materials. Thus the estimated content development cost for one hour of e-learning materials would be RM4,200. If we were to consider a 5-day training programme, the content development cost will be:

\[
\text{Cost} = (5 \text{ days} \times 6 \text{ hours}) \times \frac{1}{3} \times \text{RM}4,200 = \text{RM}42,000
\]

The eLearning Guild conducted a Development Time Ratio survey [6] to determine the time taken to develop one hour of courseware. The results are shown in table 4.

<table>
<thead>
<tr>
<th>Course Complexity</th>
<th>Development Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple</td>
<td>117</td>
</tr>
<tr>
<td>Average</td>
<td>191</td>
</tr>
<tr>
<td>Complex</td>
<td>276</td>
</tr>
</tbody>
</table>

**Table 4: Development Ratio Time [6]**
Conclusion

The discussion whether e-learning is effective is over. The discussion is now on how to make e-learning better. Learning is being shifted from *just-in-case* learning to *just-in-time* learning. E-learning will become increasingly important for learning organization as well as for the knowledge economy. E-learning will be performance-driven. Many of the metrics, ROI and KPI will still be traditional financial and performance measurements. Cost reduction and quality of content will be a KPI for e-learning.

It is important to have clear goals for the e-learning implementation. E-learning goals must reflect organizational goals. Senior management support of the project is important. We must ensure that the LMS is integrated with the LCMS and ERP/HR system so that the operation of the e-learning system is smooth. Content development cost must be budget as part of the e-learning project. Matrices must be developed to measure the degree of success of the e-learning system. Continuous support and services must be provided to the learners.
Appendix A: Summary of e-learning survey conduct at Multimedia University

**Chart 1: PC ownership among MMU students**

- **Yes**, 87
- **No**, 13

**Chart 2: Percentage of users access from home.**

- **Home**: 79%
- **Other**: 21%
Effective E-learning Content Management and Delivery: Multimedia University’s Experience

1. Online lecture notes
2. Web discussion board
3. Multimedia learning materials
4. E-mail facilities
5. Online case studies
6. Chat/messaging
7. FTP (download materials)
8. Workspace (to share files)

Chart 3: Usage of the MMLS system at Multimedia University

Are you satisfied with the current E-learning (MMLS) facilities?

- Yes: 70%
- No: 22%
- I didn't know: 8%

Chart 4: Satisfaction level among users of MMLS system.

QUALITY OF LEARNING EXPERIENCE

- Strongly agree, 5
- Strongly disagree, 11
- Agree, 38
- Disagree, 23
- Undecided, 23
- Undecided

Multimedia University
Chart 5: Quality of learning experience

![Students Preference on the type of delivery mode](chart1)

Chart 6: Preference on the type of delivery mode

![Preferred learning mode](chart2)

Chart 7: Preferred learning mode by MMU students

![Preferred learning mode by MMU students](chart3)
References:


