International Conference on Computer Science and Computational Intelligence (ICCSCI 2015)

Evaluating a Learning Management System for BINUS International School Serpong

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Abstract

The purpose of this study is evaluate a Learning Management System for Bina Nusantara International School Serpong, to make the Students, Parents, and Teachers cooperate with each other in education, with hope that the school can create more quality graduates. Methodology that will be used in the study is discussion with the school executives on features that will be implemented in Learning Management System and survey to the users to know their satisfaction about the application after being implemented. Result of this study is to implement the Learning Management System that will help the Students, Parents, and Teachers in teaching and learning activities. Conclusion of this study is by using this Learning Management System, Students, Parents, and Teachers will become more active in the teaching and learning activities inside and outside the school.

Keywords: E-Learning; Education

1. Introduction

1.1 Background

The advanced in technology gives many advantages to the people. All kinds of information can be shared easily by the technology through the Internet. People usually use their computers or gadgets to find every kind of information as fast as possible. This kind of information sharing will lead to the new learning behaviour.

Nowadays, school students use Internet to find information for their subject’s info or learning materials. They

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also use the Internet to help them finish their assignments. But, due to the ease of learning materials sharing, it will be harder to search for appropriate and trusted learning materials.

Parents of the school students also need to monitor their children’s subjects, learning materials, assignments, and score details. Without all these information, parents cannot help their children to study. The children will have to study for themselves, which sometimes will be hard and confusing without their parent’s help.

Teachers need to have an interaction with the students outside school hours. This interaction can be an open discussion, information sharing, additional assignments or materials, and so on. Teachers can also encourage their students to study and have a discussion before the class starts.

Subject’s info, main and shared learning materials, assignments, score details, and communication between teachers and students must be delivered as fast as possible. Students and teachers must be notified for all of this information with the real time web environment. This is to ensure that they have the latest information available from everyone involved in the school teaching and learning activities.

Seeing this importance, BINUS INTERNATIONAL SCHOOL Serpong wants to implement the system that can support the learning activities via internet. BINUS INTERNATIONAL SCHOOL Serpong is one of the business units under BINUS GROUP that is opened in July 2007 and accredited by the Indonesian Ministry of Education (DEPDIKNAS) as an international school. With the mission to offer a multiple-intelligences and best value education to the students in Indonesia, BINUS INTERNATIONAL SCHOOL Serpong believes that implementing this system is the right thing to do.

1.1 Problem Statement
The problem statements for this thesis are as follows:
1. How the students and parents know the objectives of subjects taught in the school?
2. How the teachers and the students communicate with each other after school hour?
3. How the parents monitor their children assignments and learning materials?
4. How the current system can notify their users about any updates just in time?

1.2 Purpose and Benefit
The purposes for implementing the Learning Management System are:
1. Giving information about the student’s objectives for each subject.
2. Sharing learning materials to the students and parents.
3. Creates an interaction between teachers and the students outside school.
4. More paperless student’s assignments.
5. Giving knowledge to the students that is not in the school textbook.

The benefits of the Learning Management System are:
1. Students and parents know the objectives of each of the school subjects.
2. Students can study the materials before the class begins.
3. Parents can monitor their children’s learning materials.
4. Teachers can interact with the students after the class.
5. Students will know which skills that still need improvements from the score details.
6. Students, parents, and teachers will be notified immediately if the new information came out.

1.3 Methodology
The methodology that is used for collecting user requirement in the writing of this thesis is Discussion. The discussion is done with the key users of BINUS INTERNATIONAL SCHOOL Serpong (Principals, Vice Principals, and Head of Departments). The purpose of this discussion is to create the appropriate features of Learning Management System based on the requirement.

The methodology that is used for the evaluation of the Learning Management System is Questionnaire Survey. This Survey is distributed for Students, Parents, and Teachers of BINUS INTERNATIONAL SCHOOL Serpong. The purpose of this Survey is to get feedbacks from the users, evaluate the feedbacks, and improving the Learning Management System.
1.4 Writing Systematic
The systematic in this writing are as follows:
1. Introduction
This chapter explains about the background, problem statement, scope, objectives and benefits, the methodology
used, as well as systematic of thesis writing.
2. Theoretical Foundation
This chapter contains the basic theories such as the general theories and specific theories that support this thesis.
3. Learning Management System General Description
This chapter describes the problems faced by the scope and limitations of the existing problems and the
formulation of the system design as a given solution.
4. System Design and Implementation
This chapter describes the requirements analysis, design, implementation plan, implementation and evaluation of
the new Learning Management System.
5. Conclusions and Suggestions
This chapter contains the conclusions resulting from the evaluation of all phases of design and implementation
that have been made as well as suggestions for further development in the future.

2. Theoretical Foundation

2.1 Internet
According to Robert W. Sebesta, “These computers are of every imaginable size, configuration, and
manufacturer. In fact, some of the devices connected to the Internet—such as plotters and printers—are not
computers at all.” Therefore, Internet nowadays gives many impacts in our routine, whether our transaction,
business, leisure time, source of getting the information, etc. are mostly using Internet. Furthermore, Internet has
provided a wide range of information and organized the information that would be beneficial for our use.

2.2 Database
Based on Connoly & Begg, “Database is a shared collection of logically related data and its description, design
to meet the information needs of an organization.” Moreover, the database can be a single or large storage that can
be access simultaneously by many users. This is because all the data has been integrated which make it possible to
all the users to access all the same data in the same time.

2.3 Unified Modelling Language (UML)
UML is a modeling language that aims in specifying, visualizing, constructing and documenting the system of
the software. It is also aim to apprehend the decisions and understand the system that should be constructed in order
to fulfill the user requirements. The UML is prepared to be used in all development methods, lifecycle stages,
application domains, and media.
The words unified in the UML, has some pertinent meaning such as:
• Across historical methods and notations. The UML merge all the general or commonly used concepts from many
object-oriented methods and give clear meaning for each concept.
• Across the development lifecycle. The UML can be used in any stages of development process. Therefore, UML
is suitable and plays important role for iterative and incremental development.
• Across application domains. Because there are several areas where general-purpose modeling language is
needed, then using UML will be very helpful for development in those areas.
• Across implementation languages and platforms. The UML designed to be able to be used in many technical
implementation including the programming language, platforms, databases, 4GLs, organization documents,
firmware and so on. Therefore, the UML for all the implementation will be identical, but the technical implementation is what differ the result.

- Across development processes. Because the UML designed to be a modeling language, therefore it will not provide the detailed of the development process.
- Across internal concepts. The UML is one of the most important results of the unification work, because it tries to capture the general and relation among the modeling concepts.

Moreover, the Visualizing in the UML means that UML is not only function as graphical language but also to be the representation for the use in programming language. The specifying in the UML means to eliminate the unambiguous make a precise and complete modeling. Next, constructing in the UML means to map the design to the technical implementation (usually the programming language) or vice versa. The last part in the UML meaning is perhaps one of the important part is the documentation. Documentation in this context focuses on recording any development and maintenance done in software development.

2.4 Data Model
Data model is a diagram that describes data in terms of the entities and relationships described by the data. It is used for the purpose of organizing and documenting the system’s data. It contains of entities, attributes, and relationships between entities.

2.5 Human-Computer Interaction (HCI)
Human-Computer Interaction (HCI) is a discipline that related to design, implementation, and evaluation of interactive computer systems. The main focus of the Human-Computer Interaction (HCI) is to design and evaluate the user interface because user interface is the bridge between computer and human for interacting with the system.

Based on Shneiderman & Plaisant, There are five usability measures in designing the user interface, such as:
- Time to learn; is the amount of time that is needed for the user to learn how to use the relevant action to accomplish certain task.
- Speed of performance; is how much time needed to accomplish certain tasks.
- Rate of errors by users; is how many errors and its error type that occurs when users try to accomplish the task.
- Retention over time; is the ability of user to keep their knowledge on how to use the system after certain amount of time.
- Subjective satisfaction; is the level of satisfaction of user over certain aspects of the interface.

2.6 Learning Management System (LMS)
Based on Rahman, Ghazali and Ismail, Learning Management System is a system in which should be able to integrate the content, delivery and management of learning in term of its user accessibility. The users here include the learners, content creators and administrator. According to and Wajeha Thabit Al-Ani, The LMS goal is to provide services that can be use by the teacher and student to support the collaborative learning activities other than traditional classroom learning activities.

2.7 Real-Time
According to Rohit Rai, the term real-time refers to measurement of time between the occurring and delivery time of the event. Rohit Rai also elaborates the importance of web application to implement real-time technology; this is because there are already changes in implementation and cost for the real-time functionality. Real-time functionality has changed from fancy feature to user necessity, from the challenging piece of application into standard in the form of WebSockets and Server-Sent Events (SSE).

2.8 SignalR
Based on Ivan & Popa, “SignalR is an Asynchronous library for .NET to help build real-time, multi-user interactive applications and is based on long polling techniques.” And long polling itself according to Ivan & Popa, is a variety of conventional technique and let the copy of the information push from the server to the client.
Moreover, Long polling is not a push code, but rather usable when the real push is not possible to be done. Ivan & Popa also added that SignalR reflect the implementation of long polling but it does not rely solely only to the long polling technique because it has another concepts of transports that decides how data is sent/received and how it connects and disconnects. The transports that develop in SignalR are: WebSockets, Server Sent Events, Forever Frame, Long polling, though WebSockets and Server Sent Events still not widely supported at current time. From those transports that embedded in SignalR, SignalR will tries to find the “best” connection that is supported by server and client.

2.9 Waterfall Model
According to Roger S. Pressman 11, waterfall model is a software development model that has systematic sequential approach. The steps for the waterfall model are as follow:
- Communication: it includes the project initiation and the gathering of the requirements or information needed.
- Planning: it includes the estimation of the budget, workload needed, the project scheduling through timeline and tracking of the project.
- Modeling: it includes the analysis and design of the software.
- Construction: focus on the code generation and software testing to ensure the software fulfills the user requirements.
- Deployment: it includes the software delivery, support and feedback from the user.

2.10 Software Testing
Software testing is a technique that is used to analyze the software item to detect differences between existing and required conditions and to evaluate the quality of the software product. There are two basic types of software testing, black box testing and white box testing 12:
1. Black box testing or functional testing focuses on the generated outputs in response to selected outputs and execution conditions. The software tester does not or should not have access to the program’s source code.
2. White box testing or structural testing focuses on the internal structure of software code. The software tester knows what the code looks like and writes test cases by executing methods with certain parameters. The tester is most often the developer.

2.11 Survey
According to Zikmund and Babin 13, survey is a technique of research where the sample is interviewed, observed and described in some way. Moreover, surveys also need a direct participation from the respondents. Usually, the type of information that will be provided by survey is descriptive research study with several objectives like measuring the awareness, knowledge, behavior, opinions and attitudes from inside or outside the organization.

3. Evaluation
3.1 Evaluation
The evaluations for Learning Management System are as follows:
1. User Acceptance Evaluation
A user acceptance test is needed to check the application that have been developed, has met the user’s expectation. The user acceptance is done by explaining, demonstrating and giving the questionnaires to selected middle school students and high school students. The method that have been use to collect the data is simple random sampling. The populations are Binus International School Serpong’s active middle school and high school students, parents, and teachers. The population size of students is 1354 students by the academic year 2014 and academic semester 2. The authors assume that the population of parents is same with the population of students. To determine the sample size of student and parent, the authors use slovin’s formula with 5% error rate, which is:

\[ n = \frac{N}{1 + N(e^2)} = \frac{1354}{1 + 1354(0.05^2)} = 308.779 \approx 309 \]
The sample size of students and parents that will be used for reach the conclusion is 309 students and 309 parents.

The population size of teachers is 271 teachers by the academic year 2014 and academic semester 2. To determine the sample size of teacher, the authors use slovin’s formula with 5% error rate, which is:

\[
n = \frac{N}{1 + N(e^2)} = \frac{271}{1 + 271(0.05^2)} = 161.549 \approx 162
\]

The sample size of teachers that will be used for reach the conclusion is 162 teachers.

2. Five Usability Measures

a. Time to Learn

<table>
<thead>
<tr>
<th>Module</th>
<th>Student</th>
<th>Parent</th>
<th>Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Info</td>
<td>15 seconds</td>
<td>20 seconds</td>
<td>216 seconds</td>
</tr>
<tr>
<td>Materials</td>
<td>30 seconds</td>
<td>42 seconds</td>
<td>216 seconds</td>
</tr>
<tr>
<td>Forum</td>
<td>35 seconds</td>
<td>50 seconds</td>
<td>123 seconds</td>
</tr>
<tr>
<td>Assignment</td>
<td>43 seconds</td>
<td>38 seconds</td>
<td>72 seconds</td>
</tr>
<tr>
<td>Shared Materials</td>
<td>17 seconds</td>
<td>20 seconds</td>
<td>32 seconds</td>
</tr>
<tr>
<td>View Score</td>
<td>126 seconds</td>
<td>183 seconds</td>
<td>-</td>
</tr>
<tr>
<td>Notification</td>
<td>13 seconds</td>
<td>22 seconds</td>
<td>18 seconds</td>
</tr>
</tbody>
</table>

b. Speed of Performance

<table>
<thead>
<tr>
<th>Module</th>
<th>Student Desk</th>
<th>Parent Desk</th>
<th>Staff Desk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Info</td>
<td>1.3 seconds</td>
<td>1.2 seconds</td>
<td>2.4 seconds</td>
</tr>
<tr>
<td>Materials</td>
<td>0.9 seconds</td>
<td>0.8 seconds</td>
<td>1.5 seconds</td>
</tr>
<tr>
<td>Forum</td>
<td>2.8 seconds</td>
<td>3.0 seconds</td>
<td>5.2 seconds</td>
</tr>
<tr>
<td>Assignment</td>
<td>0.5 seconds</td>
<td>0.6 seconds</td>
<td>0.8 seconds</td>
</tr>
<tr>
<td>Shared Materials</td>
<td>0.6 seconds</td>
<td>0.6 seconds</td>
<td>1.0 seconds</td>
</tr>
<tr>
<td>View Score</td>
<td>2.3 seconds</td>
<td>2.0 seconds</td>
<td>-</td>
</tr>
<tr>
<td>Notification</td>
<td>1.1 seconds</td>
<td>0.8 seconds</td>
<td>0.9 seconds</td>
</tr>
</tbody>
</table>

c. Rate of errors by users

The rate of errors is represented by how many mistakes the users do when they tried the LMS for the first time. There is one mistake from the Teacher, which is when the Teacher uploads attachment in the Assignment with file type that is not allowed.

d. Retention over time

<table>
<thead>
<tr>
<th>Module</th>
<th>Student</th>
<th>Parent</th>
<th>Teacher</th>
</tr>
</thead>
</table>

Table 1. Time to Learn of LMS Modules.

Table 2. Speed of Performance for LMS Modules.

Table 3. Retention over time of LMS Modules.
Table 4. Subjective Satisfaction of LMS Modules

<table>
<thead>
<tr>
<th>User</th>
<th>Feedbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>Features in LMS are good enough. Info and Materials can help us understand the subjects. Forum is also good for communicating with our teachers. Info, Materials, and Shared Materials is really good for the parents to help the children in studying. The LMS should be developed on mobile because the parents usually open the Parent Desk through the mobile.</td>
</tr>
<tr>
<td>Parent</td>
<td>LMS is really helpful in teaching and learning activities in this school.</td>
</tr>
</tbody>
</table>

3. Application Evaluation

The Learning Management System needs to be evaluated before it is deployed and used by the Student, Parent, and Staff of Binus International School Serpong. Evaluations are taken from the result black box testing for each module in LMS.

Table 5. Info and Materials Black Box Testing

<table>
<thead>
<tr>
<th>Test ID</th>
<th>Description</th>
<th>Expected Result</th>
<th>Actual Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Subject Head add Subject Description, Learning Outcome, and Textbook.</td>
<td>Subject Description, Learning Outcome, and Textbook should be added to Draft.</td>
<td>Subject Description, Learning Outcome, and Textbook is added to Draft.</td>
</tr>
<tr>
<td>1.2</td>
<td>Subject Head add Materials.</td>
<td>Subject Description, Learning Outcome, Textbook, and Materials should be added to Draft.</td>
<td>Materials are added to Draft.</td>
</tr>
<tr>
<td>1.3</td>
<td>Subject Head submit course.</td>
<td>Subject Description, Learning Outcome, and Textbook. Materials should be published to the Student and Parent Desk and the Notification should be added.</td>
<td>Subject Description, Learning Outcome, Textbook, and Materials are published to the Student and Parent Desk and the Notification is added.</td>
</tr>
<tr>
<td>1.4</td>
<td>Subject Head add / edit Subject Description, Learning Outcome, or Textbook.</td>
<td>Subject Description, Learning Outcome, or Textbook updates should be published to the Student and Parent Desk and the Notification should be added.</td>
<td>Subject Description, Learning Outcome, or Textbook updates are published to the Student and Parent Desk and the Notifications is added.</td>
</tr>
<tr>
<td>1.5</td>
<td>Subject Head add / edit Materials.</td>
<td>Materials updates should be published to the Student and Parent Desk and the Notification should be added.</td>
<td>Materials updates are published to the Student and Parent Desk and Notification is added.</td>
</tr>
</tbody>
</table>

Table 6. Forum Black Box Testing

<table>
<thead>
<tr>
<th>Test ID</th>
<th>Description</th>
<th>Expected Result</th>
<th>Actual Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Teachers add new thread in the Forum.</td>
<td>New thread should be published to the Student and Parent Desk and the Notification should be added.</td>
<td>New thread is published to the Student and Parent Desk and the Notification should be added.</td>
</tr>
<tr>
<td>2.2</td>
<td>Students replies to the thread</td>
<td>Student’s replies should be added</td>
<td>Student’s replies are added to the</td>
</tr>
</tbody>
</table>
Table 7. Assignment Black Box Testing

<table>
<thead>
<tr>
<th>Test ID</th>
<th>Description</th>
<th>Expected Result</th>
<th>Actual Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Teacher add new assignment.</td>
<td>New assignment should be added to the Student and Parent Desk and Notification should be added.</td>
<td>New assignment is added to the Student and Parent Desk and Notification is added.</td>
</tr>
<tr>
<td>3.2</td>
<td>Student uploads assignment answer.</td>
<td>Assignment answer should be added to the answer list in Staff Desk.</td>
<td>Assignment answer is added to the answer list in Staff Desk.</td>
</tr>
<tr>
<td>3.3</td>
<td>Teacher downloads Students’ assignment answer.</td>
<td>Assignment answer should be downloaded as .zip file.</td>
<td>Assignment answer is downloaded as .zip file.</td>
</tr>
<tr>
<td>3.4</td>
<td>Due date of assignment has passed.</td>
<td>Students should not be able to upload the assignment answer.</td>
<td>Students are not able to upload the assignment answer.</td>
</tr>
</tbody>
</table>

Table 8. Shared Materials Black Box Testing

<table>
<thead>
<tr>
<th>Test ID</th>
<th>Description</th>
<th>Expected Result</th>
<th>Actual Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Teachers add new shared materials.</td>
<td>New shared materials should be added to the Student and Parent Desk and Notification should be added.</td>
<td>New shared materials should be added to the Student and Parent Desk and Notification is added.</td>
</tr>
</tbody>
</table>

Table 9. Notification Black Box Testing

<table>
<thead>
<tr>
<th>Test ID</th>
<th>Description</th>
<th>Expected Result</th>
<th>Actual Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Student, parent, and teacher open Notification page.</td>
<td>All notifications from current academic year and semester should be shown.</td>
<td>All notifications from current academic year and semester are shown.</td>
</tr>
</tbody>
</table>

Table 3.10 Score Black Box Testing

<table>
<thead>
<tr>
<th>Test ID</th>
<th>Description</th>
<th>Expected Result</th>
<th>Actual Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>Student and parent view scores of the selected subject.</td>
<td>Score details for the selected subject in the current academic year and semester should be shown.</td>
<td>Score details for the selected subject in the current academic year and semester are shown.</td>
</tr>
</tbody>
</table>

4. Conclusion and Suggestion

4.1 Conclusion

Based on the analysis and system design of Learning Management System (LMS) for Binusmaya School Student, Binusmaya School Parent and Binusmaya School Staff, it can be concluded that:

1. The students and parents can have clear objective of the subjects through the info and materials menu where students and parents can see the subjects outline and materials.
2. The students and teacher can communicate through the forum menu, to discuss any related subject materials by replying on the thread.
3. The parents can monitor and download their child assignments through the assignments menu. In this menu, parents can download the assignment given by teacher, know the due date and see whether their children has submitted or not.
4. The student, parent, and teacher can clearly be notified after any updates or addition through the notification widget. This notification widget will show the number of the notification that has not been checked by students, parents and teachers.
4.2 Suggestion

According to analysis and conclusion, there are some suggestions which can be considered for future research, which are:

1. The LMS can be accessed through Mobile School Information System application to ease the users’ access to the LMS.
2. The LMS assignments module will also have online checking and scoring. Therefore, when the students have uploaded their answer then the teacher can directly check the uploaded answer and score their answer which is connected to the score.
3. In Forum, teacher can merit and demerit students who are not behaving politely.
4. The content in info and materials menu will have approval system by the Level Head, Vice Principal and Principal.
5. When there is new notification, the system will also send a message through SMS gateway.

References