Virtual Learning Platform with Short Message Service (SMS) Notification

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Abstract

This study aimed to analyze, design, develop and evaluate a virtual learning platform with short message service text notification for SLSU. Co-Model, a combination of Waterfall model and ADDIE model was used as a framework of the system’s development. PHP and MySQL were used as primary systems development tools. An online SMS API provider was also used for sending SMS text messages. The system was launched online before the gathering and evaluation of data. It is accessible using the web address, www.lmsdemoweb.com. A descriptive survey method was used in gathering the data and adopted questionnaires were used to evaluate the performance of the developed system. The developed system was found to be outstanding in terms of functionality and debugging; it was also good in terms of complexity, interface design, and support services. The results of the functionality assessment conclude that the system is a good platform for virtual learning.

Keywords: Virtual learning; Learning management system (LMS); Short message service; SMS Text Notification

Introduction

The story of virtual worlds is something that cannot be separated from technological change (Warburton, 2009). Technology change has facilitated distance education in all disciplines, and it has proven to be popular among students for various reasons, such as convenience and equal opportunity (Cheng et al., 2010). With this, virtual learning environments (VLE) are becoming a crucial part of the education system because they are used as supplementary tools for motivating and empowering independent learning and teaching (Brengartner & Netto, 2012). In 2012, the Philippines was cited as one of the top 10 countries in the world with high growth of e-learning revenues (Domingo, 2012). With this achievement, several tertiary institutions in the country started to offer distance-learning programs like UP, Philippine Women’s University (PWU), De La Salle University, Polytechnic University of the Philippines and the Pamantasan ng Lungsod ng Maynila (Castillo, 2011). To further improve the status of e-learning in the Philippines, the Republic Act No. 10650: Open Distance Learning Act, an act expanding access to educational services by institutionalizing open distance learning in levels of tertiary education was promulgated last July 28, 2014. With this act, the Commission on Higher Education (CHED) is encouraging universities to subscribe and or build their own VLE platform, which is connected to the study conducted by the National Computing Center (NCC) in 2012, which reported that of the 112 SUCs in the country, 89 SUCs or 79.46% have web presence while 23 or 20.54% have none. Together with other...
universities, Southern Leyte State University can be considered as tough regarding web presence because it has a working website under the URL www.slsuonline.edu.ph. This website is active and accessible to all users which caters updated and useful information. However, this is not enough because SLSU has no established VLE platform, which is vital in collaborating with international and local educational entities.

VLE is not new to SLSU. Some teachers, both in graduate school and undergraduate programs were using Schoology.com as an e-learning tool in some of their classes. However, this virtual learning does not support mobile short message service (SMS) text notifications in the Philippines settings. Aside from SMS text notification, there are things to be considered before adopting VLE platform especially the open source platform. According to Lotan (2012), open-source softwares are free, but funds are required to host, maintain, and upgrade the software, as well as cover additional storage and database support. Since the user has no full control in the learning environment, it might be difficult for the institution to track all student activities and other vital information necessary to the course. When something goes wrong with the open source VLE, it is difficult to debug because it uses specific programming language, which might be new to the institution's technical support team. Regarding security, open-source VLE software might not provide the security and privacy settings required by the educational institutions. It can be deduced then that to have full control of the VLE platform, it is intuitive for SLSU to develop its own VLE platform.

This study aimed to design and develop a virtual learning environment platform with SMS text notification for SLSU. This study will allow the University to deliver learning with flexibility using SMS notifications. Through the proposed VLE, the university will have an easy way to collaborate and find partners around the globe. It will help attract local and international students. The output of this study will allow the academic offices to monitor the performance of the students, as well as the performance of the faculty in their respective classes. Academic offices will be able to trace the flow of the subject as mandated by the university and the Commission on Higher Education (CHED). With the proposed VLE System, students who have schedules and students who are from the remote places can monitor their subjects. Even without an internet connection, the students can monitor the latest updates of their course through mobile SMS text notifications. To broaden its capability and to ensure that the students are updated even if they are offline, a mobile SMS text notification was added. This mobile SMS text notification will adopt local telecommunication providers such as Smart, Globe telecommunications and other cellular services like Talk ‘N Text (TNT), Touch Mobile (TM), and Sun Cellular. The integration of available Application Programming Interface (API) allows the system to send SMS text notification to any country around the world. With this feature, the system can cater online education effectively which helps strengthen the collaboration capability of SLSU locally and abroad. After the development of the system, the performance will be assessed with regards to functionality, debugging, complexity, interface design and, support services.

**Framework of the Study**

The study was anchored to CO-MODEL by Eller (2015), which combines waterfall for the software development and ADDIE model for instructional development into one complex model. Fig. 1 shows the framework of the study.

The Software Development Life Cycle (SDLC) Waterfall Model is the main model that will be used to develop a system. It is based on the information system lifecycle processes introduced in IEEE/EIA 12207 Standard for Information Technology –
Software Life Cycle Processes (Lee et al., 2002). The software development life cycle can be described in five steps by the waterfall model: (1) Requirement analysis; (2) System Design; (3) Implementation; (4) Testing; (5) Deployment and (6) Maintenance. The standard defines processes covering the entire life cycle of a software system. The steps are well-tested to develop complex, integrated information systems (Fig. 2).

ADDIE Model

The Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model represents a descriptive guideline for building effective training and performance support tools in five phases. This model strives to save time and money by catching problems while they are still easy to fix. According to Allen (2006), ADDIE stems from a systems engineering approach and is focused on creating a student-focused, yet instructional-designer driven creation of instructional materials, and ultimately, instruction itself. Fig. 3 shows the five stages of the ADDIE model.

CO-Model

Eller, (2015) in his study Implementing Design into Instruction: Intersections between the Waterfall Model and Addie Model devised a new model known as Co-Model. This model is a combination of ADDIE and Waterfall model. This model gives instructional designers an opportunity to adopt both an instructional design process, while also incorporating software design principles like waterfall model. Co-Model is the best model in developing Virtual Learning Platform since it contains instructional and software development. Fig. 4 shows the Co-Model, the combination of Waterfall and ADDIE model.

Methodology

Research Design

This study used adopted questionnaires on software evaluation as main tools to collect the needed data. Evaluations were carried out as the study progresses using the descriptive survey method. The developed system was conceptualized based on Co-Model, a combination of Waterfall model and ADDIE
In this study, the researcher conceptualized different functions and modules to be included in the system as well as the flow of the entire system. Profiling of respondents was done, to determine specifically, through adopted questionnaires, their behavior towards virtual learning and their readiness in using virtual learning. An interview was also conducted to SLSU MIS officer to validate the institutions' facilities and equipment necessary for the implementation of the developed system. Results from the survey were utilized to develop virtual learning modules suitable to SLSU students and faculty. Preparation of different requirements such as hardware and software requirement was done in this phase. Installation of the required software like XAMP, PHP, and MySQL for the database was also

**Approach model (Fig. 4).**

**Institutional Analysis**

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Figure 4. **Co-Model (Combination of Waterfall and ADDIE model)**

accomplished in this phase.

**Course Analysis**

This phase answers the question of who will use the system, what the system will do, and where will it be used. In this study, the researcher gathered data from different readings and journals. Enrollments to different available virtual learning platforms such as Google Classroom, Schoology LMS, Moodle LMS, Instructure Canvas LMS, and Edmodo LMS were also done to have actual virtual learning experience necessary in the development of the virtual learning platform, specifically in the interface design, real-time messaging, online assessment, account management, and security.

**Learner’s Analysis**

This phase focused on finding out the basic needs of the learner. A learner's analysis or survey is a common application of this stage. In this study, an adopted questionnaire was used to identify the readiness regarding knowledge, awareness, and understanding of students and teachers towards Virtual Learning. Another adopted survey questionnaire was used to determine the needed features in the virtual learning platform as perceived by the respondents.

**Design Phase**

The developed system is a web-based application with SMS text notification from Nexmo.com, an API that specializes on Short Message Services. The design of the system follows web standards that ensure
easy access. It utilizes web programming and scripting languages such as PHP, CSS, JavaScript, JSON, JQuery, XML and other web platforms that support robust web services. MySQL was used primarily to create database functionality. Furthermore, Message-Digest Algorithm was used to enforce security and data integrity. This algorithm automatically creates hash code to all database records, which is very useful in protecting data from intruders and hackers.

**Development and Testing**

Before the development and testing stage, a separate survey assessing the level of the respondent’s readiness for knowledge, awareness, and understanding of virtual learning was conducted. Another assessment on the needed features in the virtual learning platform was conducted to ensure that the developed system is user-friendly and will meet user’s expectation towards virtual learning. In general, the primary data for the development and testing of the system are from the results of the two preliminary survey. The system was accessible to the user for testing and evaluation using the web address www.lmsdemoweb.com. Results gathered from the actual testing using adopted questionnaire was used for continued development of the system.

**Evaluation**

The system was evaluated according to its functionalities and performance. The developed VLE system was presented to teachers and students to ensure that all features are functional using the designated web address. A total of 230 respondents evaluated and tested the system. These respondents were composed of 176 3rd-year IT Programming students, 44 IT faculty, and 10 MS Information Technology students. The BS Information Technology, third year programming students were chosen as the main respondents because they already have enough experience regarding programming skills and knowledge on several computer applications, which is important in Virtual Learning.

**Research Instruments**

This study utilized adopted questionnaires. In the assessment of the performance of the developed VLE system, the adopted software evaluation questionnaire was utilized. It had five parts: part I of the questionnaire focused on the functionality of the running system; part II evaluated the functionality regarding debugging aspects; part III assessed the complexity of the system; part IV questioned the focus on the interface design of the system; and part V of the questionnaire focused on the support phase. The following rating scale was utilized to rate the performance of the developed VLE system: 5- Outstanding, 4- Good, 3- Satisfactory, 2- Poor, 1- Unsatisfactory.

**Data Collection**

To gather data on the readiness of the respondents towards virtual learning and to identify the priority features to be incorporated in the developed system, the respondents were given standardized questionnaires. After the completion of the system, the hands-on and testing were conducted, followed by the distribution of adopted Software evaluation questionnaire. Results gathered were used to identify the performance of the developed system, especially in its functionality, debugging, complexity, interface design, and support services.

**Data Analysis Procedure**

Modal interpretation was used to determine the performance of the developed system in terms of functionality, debugging, complexity, and interface design and support services.
Results and Discussions

Phase 1: Design and Development of a Virtual Learning Environment Platform with SMS Capability

The developed VLE system was organized in two accounts: Teachers and Students. The Teacher’s account can create, modify or delete courses. Teachers can also activate and disable students to the courses they created. Furthermore, teachers can send and receive instant messages from students, send email, view the personal file of each student, act as system administrators, run the service of system messages, and change and manage accounts such as passwords, access codes, and user accounts. Students, on the other hand, can be admitted for a course, and if authorized by the teacher, can access the available material of the course. The students can exchange messages with teachers through the messaging utility and can modify their passwords. Students can also send and receive instant private message, and SMS message from teachers and other students enrolled in the same course. Furthermore, the system is composed of different modules, which are necessary to create complex virtual learning platform with mobile SMS text functionality. These modules are Account Management, Grade Book, Content Management, Online Assessment, In-Class Response, Mobile Support, Collaboration Tools and Security. The architectural layout of the developed VLE system, which is ready for implementation and maintenance, is shown in Fig. 5.

Account Management

Figure 6 shows the actual page for account management. This module allows teachers and students to manage and safeguard their accounts from unwanted users.

Grade book

This module is used for monitoring the performance and the status of the students in their online quizzes and assignment submissions. Fig. 7 displays the actual interface of the grade book.

Content Management

As shown in Fig. 8, this module allows teachers and students to manage the content of different subjects. The teacher can add and remove subjects, add documents and add important discussions. The student can also manage all the contents found in their account.

Online Assessment

Online assessment modules allow teachers to create assignments and quizzes following a specific deadline. Students can view the assessment posted by teachers, and they can submit their answers directly using their account. For quiz assessment, the teacher can create multiple choice, essay and, fill-in the blanks type of exam. Assessment submitted by the teachers will be disseminated to students through the Instant message and SMS text notification. Fig. 9 shows the online assessment module.

In-Class Response

The developed VLE system allows in-class response through instant message and conversation embedded in every student and teacher’s account. This allows students and teachers to have on the spot conversations. Fig. 10 displays the interface for an in-class response.

SMS Text Notification Mobile Support

The main feature of the system is the ability to send SMS text through mobile using a local telecommunication provider, most particularly SMART and GLOBE mobile
Figure 5. Architectural layout of the proposed VLE system

Figure 6. Account management module

telecommunications. The system is anchored to Nexmo.com for sending a text. Nexmo offers unlimited text messages by providing its Program Interface (API) programmable with programming scripts. Nexmo is an open source Application Programming Interface (API) that supports SMS text notification to be embedded in the developed system. Once the
number was registered, students and teachers can receive SMS notifications every time there are new updates, deadlines, and submission of online activities. In a specific manner, once the teacher post updates to the system like online assignments, discussion threads and other online activities, the system will automatically send SMS text notification to all
enrolled students in that particular course or subject. On the side of the students, once the student makes an update to the system, like submission of an online assignment and participation in an online discussion thread, the system will send SMS text notification directly to the teacher containing the details of submission with the date and time of submission. On the other hand, students and teacher cannot reply to the text sent by the system. It is only for notification purposes that need no reply. Fig. 11 shows the mobile support module while Fig. 12 shows the detailed use case diagram of the system, particularly sending and receiving SMS text notifications to teacher and students.

Security

The security module allows teachers and students to safeguard their account from unwanted users. This module prevents non-users to interact with the system content. It requires login information such as username and password. In maintaining data integrity, Message-Digest Algorithm was used to secure data from intruders and hackers. Fig. 13 displays the interface of the security module.

Web hosting

The developed VLE system can be accessed using the temporary domain name www.lmsdemoweb.com. Fig. 14 shows the homepage of the developed system’s website.

Performance of the Developed VLE system

As can be gleaned in Table 1, the overall modal description of the developed system in terms of functionality is outstanding, which means that the systems use a web standard that is reliable, widely available, and applicable to a variety of uses. The user can operate the program independently. The information in the system is based on realistic data that is current and valid. This result will relate to the study of Jansen et al. (2009) about software ecosystems, which tells that a software with low functionality leads to the demise of many software vendors, leading to loss of competition, intellectual property, and eventually jobs in the software industry. With good performance, it is safe to say that the developed system is functional enough to handle virtual learning. On the other hand, the result of debugging is also outstanding which means that the system acknowledges input and user’s feedback, and responses were employed effectively, invalid commands are handled constructively, and the system is reliable in normal use and is bug-free. In the study of Michaeli et al. (2017), debugging is one of the key concepts concerning software

Figure 10. In-class response interface
quality because it is an approach related to computational thinking which involves processes in finding and correcting errors in programs. With outstanding results, the respondents agree that the developed VLE system is error free. Regarding complexity, the performance of the developed system is good which means that the system provides a wide variety of features. This result entails that the developed VLE system is beneficial; thus according to the study of Senan et al. (2017), good software complexity improves the code quality, reduces the maintenance cost, increases the robustness and meets the architecture standards. Furthermore, the interface design got a good review, which means that the information in the system is clear, concise, and informative to the intended user, and the system is attractive and interesting according to Granić (2017). The good interactive interface design with useable interface positively influences user experience and performance.
**Figure 13. Security module**

**Figure 14. Developed VLE website address**

**Table 1. Performance of the developed VLE system**

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Mode</th>
<th>Modal Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functionality</td>
<td>5</td>
<td>Outstanding</td>
</tr>
<tr>
<td>Debugging</td>
<td>5</td>
<td>Outstanding</td>
</tr>
<tr>
<td>Complexity</td>
<td>4</td>
<td>Good</td>
</tr>
<tr>
<td>Interface Design</td>
<td>4</td>
<td>Good</td>
</tr>
<tr>
<td>Design</td>
<td>4</td>
<td>Good</td>
</tr>
<tr>
<td>Support Services</td>
<td>4</td>
<td>Good</td>
</tr>
</tbody>
</table>

*Note: 5-Outstanding, 4-Good, 3- Satisfactory, 2-Poor, 1- Unsatisfactory*
Conclusion

The utilization of API Nexmo helped in the development of an effective SMS text notification embedded in the developed virtual learning platform which was published online. The features of the developed system such as grade book, content management, online assessment, in-class response, and mobile SMS text notification support are found to be outstanding regarding functionality and debugging. At the same time, the developed system has good performance regarding complexity, interface design, and support services. Compared to the existing open source virtual learning platform, the developed system can interact with the users in two ways. First is through in-line class response like emails and instant messages and chat. Second is through SMS text notifications where the system automatically sends a free SMS text notification prompting teachers and students about course updates, assignments and project submission and deadlines. The Developed VLE system should be used frequently to condition the mind of students and teachers that virtual learning is fun. Information dissemination and seminar workshop should be done to introduce the system to all students and teachers. Finally, an approved and updated guidelines on the conduct of virtual learning in the university are needed to solve legal problems that may arise during the implementation of the developed system.

References Cited


