

**Short Paper** 

# ICTeachMUPO: An Evaluation of Information E-Learning Module System for Faculty and Students

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#### Abstract

*Purpose* – This study explored the utilization of ICT tools and resources in developing ICTeachMUqPO. This information e-learning module system is a web-based application designed to support the academic needs of both faculty and students, in particular to track learning progress.

*Method* – The proponents conducted a group discussion and collaboration with the end users and reviewed literature on faculty development and related studies to gather preliminary information. They also identified all software and hardware specifications necessary in developing the system through a survey. The descriptive method of research was employed in designing the system evaluation process. Judgmental or purposive sampling was used in selecting the respondents (n=113) who answered the evaluation survey.

*Result* – The system evaluation survey was patterned after ISO 25010 and consisted of the following components: functionality, usability, reliability, performance, security, compatibility and supportability. The overall rating of the system was 4.11, which



indicated a "very good" grade. The portability test showed that the system can run on any computing platform using different web browser applications.

Conclusions – The result of the system evaluation by the respondent implied that the system's overall internal and external performance exhibited consistency and met the compliance requirements set by the developers.

*Recommendation* – The authors recommend that teachers and students undergo ICT capability training to get the most out of the functionalities of the ICTeachMUqPO elearning management system. The school administrators may provide support in terms of enhanced accessibility of facilities, higher internet bandwidth allocation and better network infrastructure. The proponents suggest that further research be conducted using other variables, taking another direction such as assessing the learning outcome and behavior of the students using the system.

Research Implication – E-learning or learning management systems can save faculty members time when preparing for their classes. The system can make use of additional features but in its present form it can already be a very useful educational tool to both the teacher and the student users. Making use of this technology could be an impetus for transitioning to other methods of instruction, such as online teaching.

*Keywords* – educational training, e-learning, faculty, ICT, ISO 25010 Standard, module system, student

## INTRODUCTION

Information and communication technology (ICT) has hugely contributed to the development of several disciplines, most notable of which is education. Educational communication, particularly instructional systems, has immensely benefited from ICT tools compared with other development subsectors (Robertson, 2002). These technologies are believed to greatly improve the teaching and learning experience, and allow more people from different countries to get involved in furthering human knowledge (Rodrigo, 2001). One such technology is Internet connectivity, which enables more and more students to access remote sources of information. It exposes them to diverse expert opinions and makes them aware that they are part of a global community (CEO Forum, 1997; Peha, 1995).

A growing number of classrooms today incorporate ICT into the learning environment, making them highly interactive and profitable for students and teachers alike. More methods utilizing ICT tools are being adopted by teachers and other education experts that make communication and collaboration with each other and with students easier and timelier. Formal presentations, cooperative learning activities, and informal dialogues are being held in large groups, small groups, or on a one-on-one basis (Hancock, 1997). Some researchers also believe that ICT promotes self-direction. Students learn to take control of their own learning by seeking out answers to their questions using a variety of resources made easily accessible by ICT (Carlisle & Fishback, 2015).

Training modules can integrate technology to the learning environment, where it can be an active agent that students as well as faculty/teachers can interact with (Kozma & Voogt, 2003). Technology can greatly expand the information horizons of instructors in terms of both access and structuring, and also enables effective interactions anytime, anywhere in the world. Some of the problems and issues encountered in ICT implementation in higher education are funding, curriculum mismatch with job requirements, outdated documentations, and lack of qualified trainers. The concerted effort and support of government, industries, academe, and non-government organizations are positive steps that can be taken towards narrowing these gaps (UNESCO, 2012).

Developing countries such as the Philippines are committed to infusing schools with ICT. The recently created Department of Information and Communication Technology has modernization of ICT for the State Universities and Colleges (SUCs) as one of its priorities, with a huge allocation in the 2018 budget. Congressman Winston Castelo of Quezon City, one of the principal proponents of free college tuition, said that the move towards modernizing SUCs was taken to ensure the success of R.A. 10931 or the Universal Access to Quality Tertiary Education Act (Pacpaco, 2018).

One of the priority areas on social services delivery by the Harmonized National R&D Agenda for 2013-2020 is education, where the expected outcome was producing highly skilled and globally competitive Filipinos (faculty and students) educated and trained through innovative and ICT-enabled learning methods and systems anchored in the 2002-2020 National Science and Technology Plan. The Department of Science and Technology (DOST) conducted a survey of schools that gathered baseline data on schools' Science teachers and the extent of the schools' use of ICT for instruction and other purposes. The following were identified as key problem areas for implementing ICT in basic education: (1) Teachers' fear of the technology; (2) School administrators' closed mind set to and non-appreciation of ICT in education; (3) Constraints of the annual education budget; (4) Maintenance of ICT resources and lack of technical staff; (5) Sustainability; and (6) Limited availability of educational software and courseware.

Research has indicated that the use of ICT can support new instructional approaches and make hard-to-implement instructional methods such as simulation or cooperative teaching more feasible (Carlson & Gadio, 2002). The utilization of ICT for learning and teaching in schools has grown exponentially over the past decade, especially with the increasing accessibility of resources on the Internet. Teachers now have a wider pool of resources and technology that they can pick based on their own pedagogical preferences (Choy, Suan, & Chee, 2012). However, in the situation of this study's target university, funding for developing the system and support for its maintenance are key concerns.

Methods are an integral part of teaching, and they essentially influence a teacher's entire performance in any given learning situation. Consequently, teachers nowadays should acknowledge the need for adopting different teaching methodologies (Darling-Hammond, 2010). Several theories and research on modular-related innovations have showed possible effects on students' learning in terms of learning outcomes, motivation and school output. For example, self-contained learning material may enhance students' motivation by retaining their attention and by offering the possibility of regular feedback. Students need feedback for them to determine what they need to improve and accomplish.

The prevailing situation in the immediate campus environs of the authors of this study is that teachers have hectic schedules because of unsystematic teacher designations, unscheduled meetings, commitments outside their teaching roles, and other unavoidable events. This makes strategies and approaches for quality education barely felt by the students, who could benefit from innovations such as the system proposed in this study. The current situation also affects the students' evaluation of teachers' performance as well as the monitoring of the students' learning progress. These issues provided the authors with insights on developing an ICT-based training module system as a resource material to improve progress monitoring and increase digital literacy among teachers and students alike.

The aim of this study was to develop ICTeachMUQPO: Information e-Learning Module System, an online platform that will help the target university's stakeholders (teacher/faculty and students) in monitoring their academic activities and learning progress. The system is a web application intended to provide relevant information about the academic resources available to faculty members and to facilitate communication, collaboration, and availing of other services. It can be useful to subject matter experts (SMEs) in that teaching materials can be converted into digital format and uploaded as standardized Information Education Communication (IEC) materials that can greatly enhance the students' learning process. These learning materials can be managed by the instructors and accessed by the students as well, providing them with an interactive and self-paced modular approach in learning any subject. The system also includes planned pre-test and post-test features for each module for instructors to help evaluate students on their progress, where they can also provide additional feedback.

#### **REVIEW OF RELATED SYSTEMS**

Learning management systems (LMS) are a platform used to manage, plan and assess learning process for students. With the rapid growth of ICT many universities across the globe have implemented learning management systems. Generally, most of the LMS have features such as online assignment submission and collection, automated quizzes, account registration, joining classes, and student self-enrolment. According to a report by the Center for Educational Innovation (n.d.), higher education institutions benefit from using a LMS in the following ways: (a) instructors and students have access to learning content anytime and anywhere; (b) it serves as a centralized source of learning; (c) it provides tracking and reporting tools to enhance student learning and performance; (d) increased efficiency in student activities such as assignment submission; and (e) increased communication. However, many additional features are available only through commercial/proprietary LMS, which comes at a high cost and becomes a major concern for universities looking to avail of such features.

Many open source learning management systems are available on the Internet, such as Blackboard, Canvass, Moodle, and D2L, among others. However, these non-proprietary LMS have quite a number of drawbacks compared to the commercial ones. Blackboard is a good LMS but some features like combining course sections still require users to request an administrator's permission before using. Another such restricted feature is section management – instructors are unable to release announcements or assign activities to specific sections. Canvass has similar issues with section management and has no privacy preferences: students are unable to make their names and profiles hidden from other users. Moodle heavily relies on third-party software, which increases system lag and workload when updating the LMS. In D2L, collaborative workspace or tools are not currently offered for students and teachers, students are not allowed to set due dates, and students can't hide their names and profile (UITS, 2013; Monarch Media, 2010).

Locally, one of the authors has collaborated in designing and testing an e-learning management system for the Department of Education that focused on *Araling Panlipunan* subjects (Mauricio, Cagayan, Serrano, & Balahadia, 2017). It was a responsive, web-based application that covered the teaching and assessment procedures for the *Heograpiya, Kasaysayan at Sibika* (HEKASI) subjects of the Grade 5 and 6 levels. The system limits to have the students collaborations in doing activities and monitoring the students' performance in the subject through presenting the scores in their pre-test and post-test.

The ICTeachMUQPO: Information e-Learning Module System is a web application intended to provide a platform for disseminating relevant information to faculty members and students, as well as facilitating communication and collaboration among them. This system has features common to other LMS such as online assignment submission and collection, automated quizzes, account registration, joining classes, and student self-enrolment. In addition, it has distinct functions that offer several advantages to the target beneficiary. Firstly, having its own LMS, managed and maintained by an inhouse administrator, considerably cuts cost for the university/institution. This system also enables faculty members to post announcements for their respective classes and manage their teaching materials more easily, while students are provided a wider choice of owning their learning progress through self-paced learning modules. Another feature of the system enables the student user to view the prepared module or lesson for a certain class/subject, which is bundled together with a mandatory pre-test and post-test that serve as preparation for the actual graded exam. This feature also allows the student to monitor his/her learning progress for each module and provides a platform where the instructor can give immediate -feedback for all learning activities. The system also enables students to collaborate in group activities; they can divide tasks and share their individual work through the system, so any group member can edit or give suggestions for the given activities or assignments.

The system can also be used without Internet connection. An installer for the offline application can be downloaded from the website, which makes it accessible 24/7 through desktop computers, smartphones, tablets, netbooks and laptops. Once installed, the application allows the users to browse, view, and access stored documents/files. However, Internet connection is needed to install system updates. The application runs on major computer-based or mobile-based operating systems like Microsoft Windows, Macintosh OS, Linux/Ubuntu, Android, and iOS. The online portal of the system can be accessed using any web browser application. It adjusts to the screen size of the browser; uses SSL Certificate to encrypt transactions with the web browsers, website and web server to provide security to the clientele; allows users to change, reset, and retrieve password via e-mail; automatically logs out when account session is idle or expires; has a centralized database with no limitation on the number of accounts/users.

#### METHODOLOGY

#### **Research Design**

The developmental methodology was adopted in designing and creating the system. This method is a process of devising, creating, and assessing systems, processes, and applications, which must exceed different standards of acceptability, efficacy, and consistency. This method is often adopted in the educational context as a "systematic approach in designing, developing and evaluating instructional programs processes and products that must meet the criteria of internal consistency and effectiveness" (Richey, 1998).

The study also employed the descriptive method of research in the evaluation of the system based on its functionality, reliability, portability, usability, performance efficiency, security, compatibility, and maintainability. The evaluation form was based on the ISO 25010 standard.

Judgment or purposive sampling was employed in selecting the respondents who evaluated the proposed system. This technique assumes that the researcher is able to select respondents who represent a 'typical sample' from the appropriate target population. The quality of samples selected by the researcher using this approach is subject to different interpretations given that what is being evaluated is a learning system application.

The total number respondents of the study was 113, which were composed of 15 faculty members/teachers and 98 students from seven colleges/departments at the Laguna State Polytechnic University in the Siniloan and Nagcarlan campuses. Majority of the respondents were education majors from the College of Teacher Education (BSE and BSEd) and the College of Agriculture (BS AgEd) who were in their third year of study.

The researcher used various techniques to gather important data for the study. Data were collected using (1) an initial pre-survey form, (2) faculty/teacher background and feedback form, and (3) a research questionnaire based on ISO 25010 standards.

#### **Initial Pre-Survey Results**

The researcher conducted a pre-survey about difficulties that faculty members/teachers experience in terms of using technology in their work (see Appendix A). Respondents came from the different departments at LSPU Siniloan and were selected randomly. A total of 33 respondents were selected, the ratio of which was determined according to the number of faculty members and the number of undergraduate programs offered per college/department. Most of the respondents (12, or 36%) were from the College of Teacher Education, 6 (or 8%) from the College of Arts and Science, 5 (or 15%) from the College of Business Management Administration, 4 or (12%) from the College of Agriculture, and 2 respondents each from the College of Hotel Management and Tourism, College of Criminal Justice Education, and the Institute of Agricultural Engineering.

## Faculty/Teacher Background and Feedback

Majority of the respondents (87.9 %) said that they need to have access to the Internet as a resource for their teaching materials. Respondents who were 45 years old or below and had less than 10 years of teaching experience had a stronger perception of the learning management system (e-learning). Overall, the respondents showed a positive outlook toward the use of ICT tools in teaching (e-learning), believing that it is a tool that enhances learning. Some challenges and obstacles of e-learning that the respondents brought up included, among others: lack of ICT skills and learning tools/equipment, insufficient knowledge that can create impediments to teaching e-learning courses, etc.

## **Research Instrument**

The ISO 25010 standard evaluation as instruments for software development can be utilized and its aspects of user communities should be considered as a high-level attribute because of the level of influence on both construction and product acceptance (Miguel, Mauricio, & Rodríguez, 2014). The ISO 25010 standard model can be used to establish a

baseline vocabulary for managing software product quality in the opinion and perspective of individual respondents. However, they need practices with which to elicit, specify, analyze, and validate quality requirements that will take into account their limited resources. Effective practices to improve the process and the provision of specific practices to enhance specific product quality characteristics need further research (Alberto, García-Mireles, 2016). This model served as a guide to the methodology in evaluating the system in this study.

The initial questionnaire adapted from the ISO 25010 standard was pilot tested by three (3) faculty members from the College of Engineering, three (3) from the College of Computer Studies (who also served as the IT expert evaluators), and seven (7) students each from the College of Hospitality and Management and the College of Criminal Justice and Education. The survey obtained a 'Very Good' rating, which indicated that it was reliable and easy to understand. The same questionnaire was thus used, without revision, by the actual respondents who evaluated the developed system.

The respondents tested and evaluated the system using the questionnaire on a 5point Likert scale that measured the following characteristics patterned after ISO criteria in determining standard software development: (1) Functionality - the system can effectively and efficiently adapt to different types of hardware, software, and other operational or usage environments; (2) Reliability - the system reliably facilitates the accomplishment of specified tasks and objectives in every module or panel; (3) Portability - the system can adapt to different hardware, software, or other operational specifications; (4) Usability - the system allows the users greater control with its wide range of characteristics and capabilities to achieve a goal in a specified context of use; (5) Performance - the system has good response, processing, and throughput when performing its functions but depends on less resources; (6) Security - the system ensures that data are accessible only to authorized users; (7) Compatibility - the system can perform the required functions effectively while sharing a common environment and resources with other products without impacting the usage of resources; and (8) Maintainability - the system enables the user to modify the system's settings without producing any defect or degrading its quality. Table 1 below shows the corresponding verbal interpretation of the Likert scores.

Table	Table 1. Likert Scale for System Evaluation						
Rating	Mean Range	Verbal Interpretation					
5	4.21-5.00	Excellent					
4	3.31-4.20	Very Good					
3	2.61-3.30	Satisfactory					
2	1.81-2.60	Fair					
1	1.00-1.80	Poor					

The questionnaire included instructions on how to answer the evaluation form. In addition, the authors briefed the respondents about the purpose of the study and

demonstrated how to mark the Likert scales by checking the box corresponding to the rating for each performance indicator based on the ISO criteria. The questions were written in both English and Tagalog to facilitate understanding of the meaning of each indicator on the software evaluation survey.

#### **The Proposed System**

The proposed system was developed to introduce an e-learning management system to the faculty and students of the Laguna State Polytechnic University. The system's processes are anchored on the traditional, modular method of instruction while maintaining a student-centered approach. The system promotes the utilization of ICT resources in a learning environment and helps in reducing cost for acquiring learning materials. It also provides faculty members with a platform to manage other (nonteaching) tasks or administrative functions, upload instructional materials for their lessons/classes, as well as monitor their students' progress.

The system was developed using PHP with PDO, JavaScript, AJAX, HTML 5.0, CSS3, jQuery, and MySQL. The web hosting domain was encrypted with SSL encryption to secure the contents and personal information of the users. It can be accessed on any portable device such as laptops, tablets, and smartphones running on any operating system (OS) and with Internet connectivity (see Figure 1).



Figure 1. Based on the portability test, ICTeachMUqPO can run on any platform

A portability test was performed to test run the system using different hardware, operating systems, and web browsers. The system ran without a hitch on the following devices: iMac Pro, LG desktop computer, Dell Laptop, Netbook, Samsung Galaxy Tab 2, and  $O^+3$  smartphone. It worked on the following operating systems (OS): Windows 7, Windows 8, Windows 10, Linux-Ubuntu, Mac OS, iOS, and Android OS. It was fully functional on the following web browsers: Google Chrome, Mozilla Firefox, Opera, Internet Explorer, Safari, UC Browser, Opera Mini, Maxton, Briskbard and Chromium (see Figure 1).



Figure 2. The main page and the manual

The system can be accessed on any Internet browser at https://icteduc.info/. The website initially displays the Homepage of the Information e-Learning Module System (Figure 2). This page contains the login form, registration form for new users, and a link to the system manual. Profile of registered faculty members and testimonials from students are also shown on the homepage.

At least 1Mbps bandwidth speed is needed to load the web pages and for the website processes to function. Uploading big file sizes will require a bandwidth higher than 1Mbps for faster processing. The system's average response time changes depending on the bandwidth speed: below 1Mbps (1 minute or more), 1Mbps (15-18 seconds), 3Mbps (9-10 seconds), 5Mbps (6-8 seconds) and 10Mbps or higher (3-5 seconds).



Figure 3. The system's process flow diagram

For new faculty/teacher and student users, a one-time registration is needed to create a user account for system access. Figure 3 above shows the system process flow diagram for teachers' and students' activities.

	ACTION	TEACHER	STUDENT
1	Login	After Login, Create Class	After Login, View Faculty
2	Create Class	Create a Class for specific course and section	View and join class, request for code
3	Approval	Selected student to join the class then approve	If approved can view class
4	Upload Module	Upload module/lesson, Create pre-test with alloted time and show module	Take exam, answer pre-test then proceed to view module then the post-test
	Exam Result	View exam the post-test and open tne next module	Take post-test, view the next module or lesson

Figure 4. Basic actions and simple steps to access the system

Once registered, the teacher or student can perform five general actions in the system. For the teacher, these are: (1) Login, for which the user can reset his/her password using his/her institutional e-mail address; (2) Create Class, where class codes are generated; (3) Approval, where students enrolled to a particular class can be verified through the registrar enrolment system or the faculty class list; (4) Upload Module, which allows for students to catch up on missed lessons and take a multiple choice pre-test evaluation; and (5) Exam Result, where results of all the students' pre-test and post-test exams can be viewed and where the modules or lessons can be closed for access.

Student users, after logging in, can view information about the class they're enrolled in, including the name of the instructor. They will be asked to join the class if their names are in the class list and the instructor has granted his/her approval in the system. Before they can view the modules or lessons, the students will be made to take a pre-test first within a set time limit. Upon completing the module, they will then be given a post-test (also with time limit), after which module/lesson will be closed. A student can only see his/her own test results and cannot view those of other students. All these actions are further elaborated in the succeeding paragraphs.

	// Profile // Class // Logo	ut			Septe	mbor 13, 2018
	CLASS LIS	Т			Create	<b>)</b> 0
Flaviano	Class Name	Code	Approved	Pending	Action	
Llames Urera	Mathematics 101	064686	1	0	Upload   Open	
Jr.	ICT Training Module	213135	1	0	Upload   Close	
	BAANTEC	557473	21	0	Upload   Close	
	BAFBAN	276178	0	0	Upload   Close	
	EDTECH 2	838042	0	0	Upload   Close	
	BAFANAM	188237	0	0	Upload   Close	
	BAFEDM	847287	1	0	Upload   Open	
	BAFNAM	259340	1	0	Upload   Close	

Figure 5. The faculty/teacher's page and all created class

Figure 5 is a screenshot of the faculty/teacher's page, which shows the class list (class name or subjects, class security code, approved number of students enrolled in the class, and number of pending requests for approval to join class). Security codes are automatically generated once a class is created (see Figure 6).

Class Name	Code	Approved	Pending	Action
Mathematics 101	064686	1	0	Upload   Open
ICT Training Module	213135	1	0	Upload   Close
BAANTEC	557473	21	0	Upload   Close

Figure 6. Security code

Figure 7 shows the class/subject page where the teacher can set the pre-test and posttest schedules for students and upload the learning material (in PDF). The "Show" link needs to be selected to make the subject viewable to the students. Each class/subject has a class code that is required when joining the class. This is an important feature of the system because not everyone will be able to join the class if not given this code. The codes were generated using the *rand()* function, which gives a 6 digit random number from 1 to 1000000.

Vathemat	ics 101			
Title	Exam Time I	Duration	File Document	#
Max. Upload of 5MB. A	lowed Filles (pdf)	klsx docx pp	tx doc xls ppt)	
Title	Minutes	Seconds	Choose File No file chosen	Upload
Title	Exam Time Duration		Action	
Survey Result	1:30 Minute	Pre-Test	view   Show   Close Post-Test   View	w Result
ICTeachMUqPO		0 Minutes Pre-Test I view I Show I Open Post-Test I View Pesult		

## Figure 7. Upload Modules/Lesson

Inst Choice	2nd	2nd Choice 4th Choice Submit	Enter Second	I Choice Choice	
hird Choice orrect Answer	2nd	4th Choice Submit	Enter Fourth	Choice	
1at	2nd	Submit			
1at	2nd	ard			
Functionality	B. Portability	C. Security	D. Efficiency	в	Edit
A. Reliability	B. Usability	C. Compatibility	D. Maintainability	с	Edit
	A. Reliability	A. Reliability B. Usability	A. Reliability B. C. Compatibility	A. Reliability B. C. D. Maintainability	A. Reliability B. C. D. Maintainability C.

Figure 8. A multiple-choice pre-test and post-test questions

Figure 8 shows a sample of the pre-test page. The test has multiple choice questions, which the students can answer by inputting the letter only. The number of items will depend on the time limit set by the instructor when the lesson was uploaded.

	Profile    Class    Logout BAANTEC   Final Exam Modul	e	September 15
	Picture Name	Pre-Test Result	Post-Test Result
Flaviano	Ma.Christina B. Gonzales	19 out of 22	20 out of 22
Llames Urera Jr.	Jessica R. Marasigan	11 out of 22	15 out of 22
	Maricel O. Maala	1 out of 22	13 out of 22
	Angelica A. Yu	15 out of 22	15 out of 22
	Jerisa Cabisada	6 out of 22	13 out of 22
	🍵 John Paul Abila	12 out of 22	18 out of 22

Figure 9. View the pre-test and post-test result

Figure 9 shows the summary page where the instructor can see the individual results of students in both tests. Here the instructor will be able to tell at a glance if there is an improvement in the scores of any student.

	// Profile	// Faculty // My Class // Te	stimonial // Logout	Septemb	or 15, 20
	Fac	ulty List			2
	Ploture				-
Jun Urera		Flaviano Llames Urera Jr.	flaviano urera@lispu.edu.ph	View Class	
	-	joy	joy adriaa@lapu edu ph	View Glass	
	-	Arlene Cuevarra Advento	arlene.advento@ispu.edu.ph	View Class	
		Aurora bitva bion	aurora.sionģģispu.edu.ph	View Class	
	1	Varona Vintuan Zolota	varona zoleta@tspu ndu ph	View Class	
	-	Estanistan Anero Barros	estanistan ramosittison edu ph	Van Cheve	

Figure 10. The Faculty List menu on the Student Page

Figure 10 displays the student page which has the Student Profile, Faculty, My Class, and Testimonial or Feedback menus. On this page the student can view and join classes offered by different instructors. As mentioned earlier, the student needs a class code in order to join a particular class, subject to the faculty/teacher's approval.

Class	Action
BSFT-411 - AY 2018-19	View Module   Exam Resul
Mathematics 101	View Module   Exam Resul
BAANTEC	View Module   Exam Resul
EDUC100B	View Module   Exam Resul
educ 100	View Module   Exam Resul
EDUC 3 - Facilitating Learning	View Module   Exam Resul
ENGLISH	View Module   Exam Resul
Method of Research	View Module   Exam Resul
CT Training Module	View Module   Exam Resul
BAFEDM	View Module   Exam Resul
TEC 206	View Module   Exam Resu
BAFNAM	View Module   Exam Resu

Figure 11. Class/subject list on the student page

Figure 11 shows the student's page where the list of subjects/classes that the student joined can be viewed. The student will have access to the class module or lesson upon approval by the subject's instructor. Figure 12 shows the page where the student can access the pre-test exam, while Figure 13 shows the results page for both the pre- and post-test exams. The results are confidential and can only be seen by the student and the instructor.

Mathematics 101		_
Title	Action	
Survey Result ICTeachMUqPO	View File	
Descriptive Statistics	Take Exam	

Figure 12. View and take a pre-test exam

Mathematics 101		
Title	Pre-Test	Post-Test
Survey Result ICTeachMUqPO	0 out of 2	2 out of 2
Descriptive Statistics	No Exam Yet	No Exam Yet

Figure 13. View exam results

Figure 14 below is a screenshot of the same page after the module has been completed. The lesson will be closed and only the link for the post-test will be available to the student.

Mathematics 101	
Title	Action
Survey Result ICTeachMUqPO	View File
Descriptive Statistics	Take Post-Test

Figure 14. Module post-test screen

Figure 15 shows a partial view of the online test, which has multiple choice items that the student needs to answer all within the time limit specified by the instructor.

No.	Question	Answer
1	Which of the following provides a measure of central location for the data? A standard deviation B mean C. variance D range	Answer
2	A numerical value used as a summary measure for a sample, such as sample mean, is known as a: a. population parameter b. sample parameter c. sample statistic d. population mean	Answer
3	When the data are skewed to the right, the measure of Skewness will be: a. negative c. positive b. zero d. one	Answer

Figure 15. Taking up the exam

Figure 16 shows the results page for both tests.

Mathematics 101   Descriptive Statistics Module						
Picture	Name	Pre-Test Result	Post-Test Result			
	Jun Urera	3 out of 3	3 out of 3			

Figure 16. View and take the pre-test

Figure 17 shows a snapshot of the testimonials/feedback statements that the students can submit in the system. Comments can be entered in text format only.



Figure 17. View feedback section

The instructor can reply to feedback submitted by students or post comments using the reply form shown in Figure 18.

Fee	dback	
Reply		
	Submit	

Figure 18. Feedback reply form

Figure 19 below shows the page where teachers/instructors can keep track of their students' completion of course activities and requirements.

1			
1	Ma.Christina B. Gonzales	No Exam Yet	No Exam Yet
I	Jessica R. Marasigan	No Exam Yet	No Exam Yet
-	Maricel O. Maala	No Exam Yet	No Exam Yet
	Angelica A. Yu	No Exam Yet	No Exam Yet
<u>()</u> ,	Jerisa Cabisada	No Exam Yet	No Exam Yet
7	John Paul Abila	No Exam Yet	No Exam Yet

Figure 19. Monitor status for the exam, activities and exercises



Figure 20. Offline application interface

The application can be downloaded for offline use or for use within a local network. The system will open in a local host, with the same features as the online version. Using the same access point of the instructor's desktop or laptop computer, the student will be able to log on and access the system. Some of the limitations of the system that can be improved in the future are: (1) the website's interface and functionalities were designed exclusively for the use of the faculty and students of the beneficiary institution, LSPU; (2) it cannot send SMS notifications; (3) maximum file size for upload is only 5MB; (4) only a handful of popular document formats (pdf, xls/xlsx, doc/docx, ppt/pptx) can be uploaded.

## **RESULTS AND DISCUSSION**

The result of the overall performance of the system obtained through testing and evaluation revealed that the objectives of the system development project have been met adequately. Its primary aim was to provide convenience to faculty members/teachers when preparing their lessons and conducting simple assessments. Several features of the system contributed to its effectiveness in achieving this aim. Acceptability of the system was high, thus indicating that it can be readily implemented within the educational organization. The respondents also showed positive attitude towards the ICT integration research project, believing that it will be effective and beneficial for the students to engage more in learning. The students can potentially enhance and develop their skills more with frequent use of the proposed e-learning system. The overall ratings are shown in Table 2.

Measure	Weighted Mean	Descriptive Rating
Functionality	4.13	Very Good
Reliability	4.16	Very Good
Portability	4.32	Excellent
Usability	4.06	Very Good
Performance	4.11	Very Good
Security	4.13	Very Good
Compatibility	3.94	Very Good
Maintainability	4.00	Very Good
Grand Mean	4.11	Very Good

Table 2. Result of the evaluation of information e-learning module system

The system evaluation was based on the following ISO 25010 criteria: functionality, reliability, portability, usability, performance, security, compatibility, and maintainability. The overall rating based on the sum of the weighted means is "Very Good". The system scored "Very Good" in terms of Functionality, which indicates that it can effectively and efficiently adapt to different types of hardware, software, and other operational or usage environments.

The Reliability score was also "Very Good", indicating that the system reliably facilitates the accomplishment of specified tasks and objectives in every module or panel. Among the several sub-criteria under reliability, its availability had the highest overall score, since the developed system was operational and accessible when required for use.

The Portability criteria of the developed system obtained an "Excellent" rating. The adaptability indicator had the highest overall score among the five indicators under the portability criteria, which means that the system can adapt to different hardware, software, or other operational specifications.

The Usability of the system also obtained a "Very Good" score. The accessibility indicator ranked first among the several sub-indicators under Usability, since the system allows the users greater control with its wide range of characteristics and capabilities to achieve a goal in a specified context of use. This is more so since most users are already equipped with knowledge and access to the latest trend in technologies like mobile devices and social media, which have been integrated into the system.

The system also got high scores in the Performance criteria. During system testing, the users were provided with stable bandwidth access (at least 3 to 5Mbps Internet connectivity). Higher bandwidth will provide the system with better response, processing, and throughput when performing its functions. Further, the performance efficiency of the system will depend on the types of resources used in accessing the system.

The system's Security score was also high, with very good scores in terms of the confidentiality, accountability, and integrity sub-factors. It has a multiple security log-in access feature for every type of users, which ensures that data are accessible only to those authorized to have access. It also prevents unauthorized access to modify data and stores auditable records that show every action undertaken.

The Compatibility aspect of the system also got a "Very Good" overall score. It shows that the system performed the required functions effectively while sharing a common environment and resources with other products without impacting the usage of resources. The system's compatibility is also related to its portability. It means that the system can be accessed by through another device in a network, providing an avenue for the exchange and use of information.

The Maintainability score was also "Very Good". Among the sub-indicators, testability had the highest mean score. The system enables the user to modify the system's settings without producing any defect or degrading its quality.

#### CONCLUSIONS AND RECOMMENDATIONS

Based on the foregoing results of the evaluation using ISO 25010 standards criteria, it can be concluded that the system has successfully performed according to the desired specifications. The high scores it received in the evaluation and performance compliance tests show that the system can be an effective, efficient and quality e-learning tool that is ready for implementation.

It is therefore recommended that; (1) Faculty/teachers and students be encouraged to utilize the system to have more control over their teaching or learning needs; (2) Faculty/teachers and students, especially from the teaching education program, conduct an ICT skills training in order to extract the most benefit from the learning management system; (3) School administrators and officials provide support in terms of accessibility of facilities and better Internet connectivity and network infrastructure, and; (4) Further research be conducted using other variables such as sociological, environmental, behavioral, and economic variables in assessing the learning outcome of the students who are using the e-learning management system.

## IMPLICATIONS

When information and communication technology (ICT) first hit the limelight in the development arena during the nineties, one of its most logical areas of application was education (Robertson, 2002; Reynolds et al., 2003). With the integration of this resource access to a huge number of innovative learning tools has been made possible through the internet. At the moment, ICT tools have only been utilized in computer-related subjects or curricula in LSPU. The e-learning system developed in this study can be a starting point to widen the extent of teaching and learning methods available to both instructors and students, with the requisite support of the learning institution itself.

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Include here the funding institution.

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## **APPENDIX A – Questionnaires**

SURVEY FORM					
Name:	Nickname				
(Optional)					
Teacher: Vear in Service: Student: Course	Year:				
Position: Instructor					
Assistant Professor					
Associate Professor					
Professor					
Part I - ICT Equipment and Learning Management 1. Portable mobile devices used regularly, no of unit/s:					
Laptop Mobile Phones Tablet Netbook	other:				
2. Connectivity protocol use:					
Local Ethernet WiFi Mobile Data Blueto	both 🗌				
3. Usage and Communication ways of the portable devices:					
Text/Call 🗌 Internet based 🗌 Social Network 🗌 Produ	ctivity Tool				
<ol> <li>Views about using Portable mobile devices in educational setting: Nonder:</li> </ol>					
Very Necessary Necessary but has difficulties Not sure	Make life easier but not necessary 🗌				
Learning Environment: Theoretical Courses Applied Courses OJT/Field Study/Im	mersion Distance Learning				
5. Have knowledge to educational learning management; YES N	<b>D</b> if yes, check below list				
Edmodo Moodle NeoLMS Atutor Chalkup	other:				
6. Attended seminar about online, distance, technology learning; YE	S NO if yes, check below list				
Seminar/Training	Date				

#### DEVELOPMENT AND EVALUATION OF INFORMATION TRAINING MODULE SYSTEM SURVEY FORM

PART 2 - Using the scale below evaluate interactive learning module criterion by placing check (v) mark on the appropriate column.

- 5 Excellent
- 4 Very Good
- 3 Satisfactory
- 2 Fair
- 1 Poor

#### A. Functional Suitability

	Indicators	5	4	3	2	1
Completeness	The set of functions covers all the specified tasks and					
-	user objectives.					
	Ang buong sistema ay sumasaklaw sa lahat ng tinukoy na					
	mga gawain at mga layunin ng gumagamit.					
Correctness	The function provides the correct results with the					
	needed degree of precision.					
	Ang sistema ay nagbibigay ng tamang resulta sa					
	kinakailangang antas ng katumpakan.					
Appropriateness	The function facilities the accomplishment of					
	specified tasks and objectives.					
	Ang paggamit sa sistema ay nangangasiwa sa pagtupad ng					
	tiyakang mga gawain at layunin.					

#### B. Reliability

	Indicators	5	4	3	2	1
Maturity	A system, product or component meets for reliability					
	under normal operation.					
	Ang sistema, produkto o bahagi nito ay nakatutugon at					
	maaasahan sa ilalim ng normal na operasyon.					
Availability	A product or system is operational and accessible					
	when required for use.					
	Ang produkto o sistema ay gumagana at maaaring					
	makuha kapag kinakailangan para sa paggamit.					
Fault tolerance	A system, product or component operates as intended					
	despite the presence of hardware or software results.					
	Ang sistema, produkto o bahagi nito ay inaasahang					
	mapatatakbo sa kabila ng pagkakaroon ng hardware o					
	software.					
Recoverability	In the event of an interruption or a failure, a product					
	or system can recover the data establish the desired					
	state of the system.					
	Sa kaganapan ng pagkagambala o kabiguang magamit					
	ang sistema, maaaring mabawi ng produkto o sistema					
	ang data na tuwirang apektado at muling mabalik ang					
	nais na estado ng sistema.					

#### C. Portability

	Indicators	5	4	3	2	1
Adaptability	A product or system can effectively and efficiently be					
	adapted for different or evolving hardware, software					
	or other operational or usage environments.					
	Ang produkto o sistema ay maaaring epektib at mahusay					
	na maiaakma para sa iba't ibang hardware, software o iba					
	pang mga uri ng pagpapatakbo o paggamit.					
Durability	A product or system can withstand technology					
	evolution and changes without costly redesign,					
	reconfiguration or recoding.					
	Ang produkto o sistema ay maaaring tumagal sa ebolusyon					
	ng teknolohiya at pagbago ng hindi mahal na muling					
	idisenyo, pagsasaayos o pakukudigo.					
Installability	A product or system can be successfully installed					
	and/or uninstalled in a specified environment.					
	Ang produkto o sistema ay maaaring matagumpay na					
	maikabit at matanggal ng naaayon sa pangangailangan.					
Replaceability	A product can replace another specified software					
	product for the same purpose in the same					
	environment.					
	Ang produkto ay maaaring palitan ng isa pang tiyak na					
	produkto na software para sa parehong layunin sa					
	parehong kaligiran.					
Affordability	A product or system can increase efficiency and					
	productivity by reducing the time and costs involved					
	in delivering instruction.					
	Ang produkto o sistema ay maaaring tumaas ang					
	kakayahan at pagiging produktibo sa pamamagitan ng					
	pabawas ng oras at paggugol sa katulad na kapaligiran.					

#### D. Usability

	Indicators	5	4	3	2	1
Appropriateness	Users can recognize whether a product or system is					
Recognizability	appropriate for their needs.					
	Makikilala ng mga gumagamit kung ang produkto o					
	sistema ay angkop para sa kanilang mga					
	pangangailangan.					

Learnability	A product or system enables the user to learn how to use it with effectiveness, efficiency in emergency situations. Ang produkto o sistema ay nagbibigay daan upang malaman ng gumagimit kung paano ito gamitin nang			
	epektibo, at mabisa sa mga panahon ng pangangailangan.			
Operability	A product or system is easy to operate, control and appropriate to use. Ang produkto o sistema ay madaling gamitin, kontrolin at angkop na gamitin.			
User error	A product or system protects users against making			
protection	errors.			
	Ginagabayan ng produkto o sistema ang mga gumagamit nito upang maiwasan ang mga pagkakamali.			
User interface	A user interface enables pleasing and satisfying			
aesthetics	interactions for the user. Ang user interface ay nagbibigay kasiyahan at kaluguran para sa mga gumagamit nito.			
Accessibility	A product or system can be used by people with the			
	widest range of characteristics and capabilities to achieve a specified goal in a specified context of use. Ang produkto o sistema ay maaaring gamitin ng mga tao na may pinakamalawak na hanay ng mga katangian at kakayahan upang makamit ang tiyak na layunin sa isang tinukoy na konteksto ng pagaamit.			

#### E. Performance Efficiency

	Indicators	5	4	3	2	1
Time-behavior	The response and processing times and throughput					
	rates of a product or system, when performing its					
	functions, meet requirements.					
	Nakatutugon ang sistema sa mga kinakailangan oras ng					
	pagtugon at pagproseso at mga antas ng throughput ng					
	isang produkto o sistema, kapag nakapagsasagawa ng					
	tungkulin nito.					
Resource	The amounts and types of resources used by a					
utilization	product or system, when performing its functions,					
	meet requirements.					
	Ang halaga at uri ng mga mapagkukunan na ginamit ng					
	sistema, kapag gumaganap ng tungkulin nito ay					
	nakatutugon sa mga pangangailangan.					
Capacity	The maximum limits of the product or system,					
	parameter meet requirements.					
	Nagtutugunan ng pinakamataas ng limitasyon o parametro					
	ng sistema ang mga pangangailangan.					

F. Security						
	Indicators	5	4	3	2	1
Confidentiality	The prototype ensures that data are accessible only to these authorized to have access					
	Tigitiyak na sistema na ana maa datas ay nakukuka lamana					
	ng mga awtorisadong magkaroon ng access nito.					
Integrity	A system, product or component prevents					
	unauthorized access to, or modification of, computer					
	programs or data.					
	Pinipigilan ng sistema, ang di awtorisadong pag-access o					
	pagbabago ng, mga programa sa computer o data.					
Non-	Actions or events can be proven to have taken place,					
repudiation	so that the events or actions cannot be repudiated					
	later.					
	Ang mga pagkilos o mga kaganapan ay maaaring					
	mapatunayan na naganap, upang ang mga pangyayari o					
	mga pagkilos ay hindi na maiwaksi/malimutan pa					
	kalaunan.					
Accountability	The actions of an entity can be traced uniquely to the					
	entity.					
	Ang mga pagkilos ng isang entity ay maaaring matukoy					
	nang katangi-tangi sa entidad.					
Authenticity	The identity of a subject or resources can be proved					
	to be the one claimed.					
	Ang pagkakakilanlan ng tinutukoy/paksa o mapagkukunan					
	ay mapatutunayan na siyang/inaangkin.					

#### G. Compatibility

	Indicators	5	4	3	2	1
Co-existence	A product can perform its required functions efficiently while sharing a common environment and resources with other products, without detrimental impact on any other product. Ang sistema ay maaaring magsagawa ng mga kinakailangang tungkulin nito nang mabisa habang nagbabahagi sa magkatulad na kapaligiran at mga mapagkukunan sa iba pang mga produkto, nang walang masamang epekto sa iba pang produkto.					
Interoperability	Two or more systems, products or components can exchange information and use the information that has been exchanged. Ang dalawa o higit pang bahagi ng sistema, produkto nito ay maaaring makapagpalitan ng impormasyon at magamit ang mga impormasyon na ipinagpapalitan.					

#### H. Maintainability

	Indicators	5	4	3	2	1
Modularity	A system or computer program is composed of discrete					
	components such that a change to one component has					
	minimal impact on other components.					
	Ang sistema o programa ng computer ay binubuo nga mga					
	hiwalay na mga bahagi na ang anumang pagbabago sa isang					
	bahagi nito ay may kaunting epekto sa iba pang mga sangkap.					
Reusability	An asset can be used in more than one system, or in					
	building other assets.					
	Ang kalidad ng kakayanan ng sistema ay maaaring gamitin					
	nang higit sa isang isang sistema, o sa pagbuo ng iba pang					
Anabashilita	mga sistema.					
Analyzability	It is possible to assess the impact on a product or system					
	of an intended change to one or more of its parts, or to					
	diagnose a product for deficiencies or causes of failures,					
	or to identify parts to be modified.					
	May posibilidad ang epekto sa produkto o sistema ng isang					
	tinangkang pagbabago sa isa o nigit pa sa mga bahagi nito, o					
	upang masuri ang isang produkto para sa mga kakulangan o					
	habaauhin					
Modifiability	A product or system can be effectively and efficiently					
,	modified without introducing defects or degrading					
	existing product quality.					
	Ang produkto o sistema ay magaring baguhin nang epektibo at					
	mabisa nang hindi nagpapakilala sa mga depekto o					
	nakakapag-pababa sa kalidad ng produkto.					
Testability	Test criteria can be established for a system, product or					
	component and tests can be performed to determine					
	whether those criteria have been met.					
	Ang pamantayan ng pagsusulit ay maaaring mabuo/magawa					
	para sa isang sistema, produkto o bahagi at maaaring isagawa					
	ang mga pagsubok upang matukoy kung natugunan ang pamantayan.					

#### Feedback:

Thank you!!!