

## USABILITY MEASUREMENT OF LEARNING MANAGEMENT SYSTEMS: A RESPONSE TO EDUCATIONAL TECHNOLOGY INFLUX

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### ABSTRACT

*Learning Management Systems are prevalent in the academic community nowadays. These developments deliver educators innovative means to provide class-related resources and activities. These technologies also unfastened a new door for educators to reach their students through its social network capability. With technology influx, users should consider what is preeminent and what conforms to the usability standards. These necessitate usability measurement. Usability is one of the most important features of software systems. Research shows that lacking to achieve user-specified goals and satisfaction would entail system failure; this was the reason for conducting the study. This research determined the usability of the three LMS used by the College of Information Technology (CIT) of the University of Negros Occidental-Recoletos. The respondents were CIT students exposed to the three LMS namely Moodle, Edmodo and Schoology. The data-gathering tool used was Software Usability Measurement Inventory (SUMI) and Human Factors Research Group (HFRG) processed the collected data using the SUMISCO software. The results revealed that Edmodo was the most usable LMS; there was a significant difference in the usability of the 3 LMS; Edmodo and Schoology's usability attributes have a significant difference, and there is no significant difference among the usability attributes.*

**Keywords :** *Learning Management Systems, Software Usability Measurement Inventory, LMS Usability Measurement, Human Computer Interaction*

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### 1. Introduction

Information and Communications Technologies (ICTs) intended for teaching and learning are a great help to many educators and learners for many years. Various research findings had proven that indeed ICT could provide a better learning experience to the students. It creates wonders in the classroom if used wisely by well-trained teachers (Alazam et. al, 2013). According to the explanatory note of one of the Philippine representative, Alfredo B. Benitez in house bill number 4993, the importance of technology in providing good quality education could not be taken for granted. Representative Benitez also elucidated that teachers should equip themselves with ICT knowledge and skills not only a mastery of their respective subjects handled. The very reason for doing this is that technology provides opportunities and resources for learning to enable teachers to cope with the emerging knowledge-based society (Benitez, 2013).

ICT in the classroom could take in many forms. These include the use of audio-visual materials in the classroom, the use of computer technology to perform a task, or providing a learning experience using the internet in the form of Learning Management Systems (LMS).

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LMS delivers a platform that incorporates content, delivery and learning management into a single system. It also allows a broad range of users to access the contents. These users may include learners, content creators, and administrators. (Rahman, 2010) LMS technology is gaining more popularity in the academe these days since learning in today's generation is not only using the traditional classroom set-up but also the internet. This development provided teachers or trainers a new venue to post requirements, materials, quizzes, and references to their students or participants in learning. This technology also opened a new door for teachers to reach the learners through social network capability of LMS.

Hundreds of LMS today are available for access. These could be proprietary like Blackboard or Desire2Learn; or open-source technologies like Edmodo, Schoology or Moodle. With the influx of these technologies, users now should consider what is best and what conforms to the quality standards from the end-users perspective. Usability measurement answers this concern.

Usability pertains to the extent to which a product or system effectively and efficiently satisfy the needs and specifications of users (Thowfeek, 2014). Usability is important for users to accept a product or system. Martin et. al (2008) noted that LMS usability is challenging. It is because LMS should be an extremely flexible system to cater to different users' needs. The system should provide many customization options at every level and which integrates components (platform, course, content generated by users) coming from different sources (developers, administrators, authors, students, tutors) for different purposes. The primary task for the student is learning, so usability should take into account the cognitive process involved in learning. Martin et. al. (2008), also highlighted that the real system users should be utilized as respondents of the study to have a comprehensive perspective of the real-life situation and that to assess the usability of each platform from their experiences.

The University of Negros Occidental-Recoletos, specifically the College of Information Technology (CIT), has been using various Learning Management Systems since 2007 to enhance the learning process for the students. These LMS include Moodle, Edmodo, and Schoology. This study aimed to assess the usability of the three LMS used by the college as perceived by the IT students who used the three LMS in any of their IT courses. Usability in this study focuses on the quality of use of software as perceived by the students themselves who accessed and made use of the three LMSs. The questionnaire used for this study was Software Usability Measurement Inventory (SUMI) questionnaire developed by Human Factors Research Group (HFRG). The result of this study will benefit the students, teachers, administration, LMS developers, and other academic institutions.

## **2. Conceptual Framework**

The umbrella of the study focuses on two concepts. One from the education that is on the modes of learning, and the other one is on Computer Science which is about Human Computer Interaction.

It is a fact that teachers commonly perform face-to-face discussion with the students. This method has been the traditional way of teaching. With the advent of technology, the blended and fully online form of teaching had been introduced.

For years, even the integration of ICT had been realized by face-to-face mode of learning in the form of radio-assisted instruction, computer-assisted instruction or television-assisted instruction (Wallet & Melgar, 2014). With the creation of internet technology, education had broken

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the walls of the classroom and provided, and extended learning experience to the student using online tools (WBT Systems, 2015)(UNESCO, 2015). Currently, the Learning Management Systems (LMS) has been gaining popularity since it provides a social network capability to reach students and assist students with their learning needs (Jethro et. al., 2012). With this popularity to both educational and training institutions, and the proliferation of the educational technologies, measuring the usability of these tools from the users' perspective is important (Martin et. al, 2008).

Usability is a Human Computer Interaction concept of the Computer Science field. Usability usually measures interface quality of a software system focusing on its effectiveness, efficiency and satisfaction with which users can perform tasks with the tool (Dillon, 2001). According to Nielsen (2003), usability assesses how easy to use user interfaces are. This is also an attribute of quality. With a usable system, a user could perform the task provided by the system, and the system responds correctly to the task given. Also, the user is provided with easy and pleasant interaction with the system (Cockton, 2013). According to Miller (2005), there is a large number of reasons for the lack of adoption of eLearning systems, and the major contributor to this reason is the poor usability. Usability is a necessary condition for survival because people will leave the website if the website fails, does not offer what users can do on the site, they get lost on the website, and the information is hard to read or does not answer user's key questions (Nielsen, 2003). These are the factors that every LMSs should consider. If institutions would want to provide a more effective or efficient learning supplement to the learning process of the students, LMSs should be evaluated before implementation. Since organizations are spending on the implementation of eLearning systems, it is just prudent to determine the extent to which they are indeed usable (Miller, 2005).

Figure 1 presents the relationship between the different concepts associated with the study based on the related literature gathered.

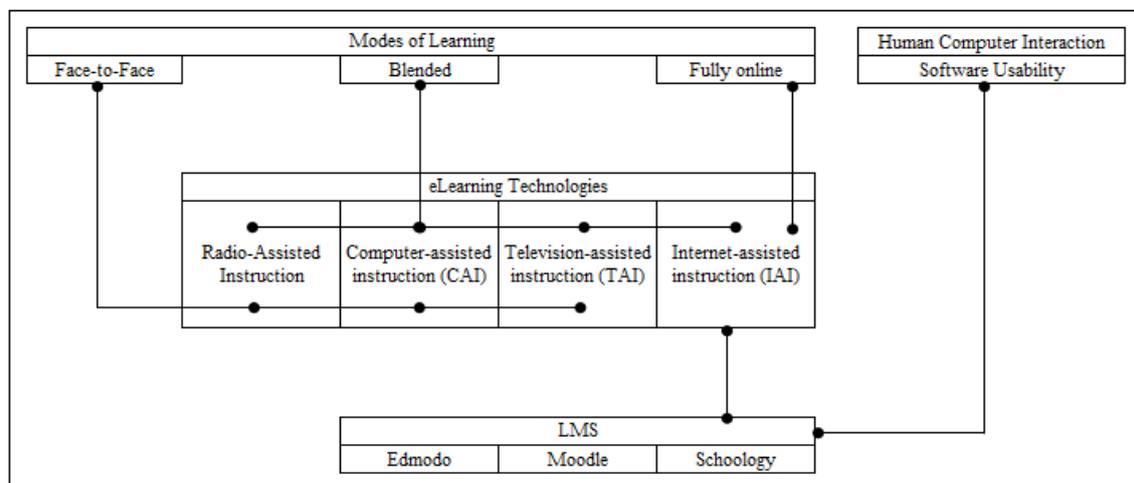


Figure 1. Conceptual Framework.

### 3. Statement of the Problem

The following are the questions that the researcher would want to find answers:

1. What is the most usable LMS?
2. Is there a significant difference in the usability of the adopted LMSs?
3. Is there a significant difference in the rating of the usability attributes of each LMS?

### 4. Hypotheses

The following are the hypotheses that this study would want to prove:

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1. there is no significant difference in the usability of the adopted LMSs; and
2. there is no significant difference in the rating of the usability attributes of each LMS.

## **5. METHODOLOGY**

This study employed quantitative research design using descriptive survey method utilizing the questionnaire from HFRG on Software Usability Measurement Inventory (Kirakowski, 2011).

The respondents of the study were 98 students from College of Information Technology (CIT). Only those students exposed to the three LMS were included. These students were the first year and fourth year students of CIT of school year 2014-2015, second semester.

### **5.1 Measures**

This study utilized a standardized questionnaire developed by HFRG named Software Usability Measurement Inventory (SUMI). This tool is a licensed questionnaire used by industries to measure software usability or quality of use. The questionnaire considers the point of view of users for evaluation and is meticulously tested and proven to measure software quality of use (Kirakowski, 2006). The Software Usability Measurement Inventory (SUMI) questionnaire has 50 questions. The response to each question was either "Agree," "Disagree" or "Don't Know". The questionnaire comprised five usability attributes (Efficiency, Affect, Helpfulness, Controllability, and Learnability) with ten questions for each usability attribute.

### **5.2 Procedure**

The researcher downloaded the questionnaire from HFRG website after securing an academic license from the said organization. After which, the questionnaire was prepared and distributed personally to the respondents. After data collection, the researcher prepared csv files following the format requirement of SUMI for data processing and was sent to HFRG specifically to Dr. Tad Kirakowski for data processing. SUMISCO was the program used to analyze the data. Their software was responsible for processing and interpreting the responses of the students. According to Kirakowski (2011), the raw question data submitted by the researcher were coded, combined, and transformed into a Global subscale, and five additional subscales called Efficiency, Affect, Helpfulness, Controllability, and Learnability. The z-score transformation was used to make the scales have an expected (population) mean of 50, and a standard deviation of 10. After processing the data, the result of the processing was emailed back to the researcher. The results were then summarized, and appropriate statistical tool was used to prove the hypotheses.

### **5.3 Data Analysis**

To answer problem statement number 1, the highest mean value as computed by HFRG was used to determine the most usable LMS. For problem statements 2 and 3 having hypotheses, the one-way analysis of variance (ANOVA) was used. Hypotheses 2 also used post-hoc Tukey HSD test to determine which pair of the identified variables has the significant effect.

## **6. RESULTS AND DISCUSSIONS**

### **6.1 The most usable LMS**

Problem statement 1 focused on determining the most usable LMS. The result of this problem will provide an idea to the administrator on what to consider as an institutional LMS. Table 2 shows the computed result from the HFRG.

*Table 2*  
Most Usable LMS.

	Usability
Edmodo	52.67
Moodle	48.44
Schoology	51.36

The result reveals that students consider Edmodo as the most usable LMS. From the comments provided by the students in line with what they like about Edmodo, majority mentioned about the user-interface. According to the students' feedback, Edmodo is similar to Facebook, the most popular social networking site. The result also shows that Moodle gets the lowest mean score. According to Tee et. al. (2013), majority of the concerns of teachers and students in their research on Moodle's usability was on icons. "They were confused by the icons and thought that the design was poor."

The world's leading business review platform, g2crowd.com also showed a comparison of reviews of the three LMSs (Edmodo, Moodle, and Schoology) which provides a confirmation of this research result. In line with the comparison result, Edmodo leads over the two other LMSs in 6 out of 7 areas. These areas include meeting user requirements, usability, setup, maintenance support, and ease of business. Schoology led the 7th criteria on Product direction. From the result, Moodle also got the lowest review result. (G2 Crowd, 2015)

## 6.2 Significant difference in the usability of the adopted LMSs.

HFRG using their SUMISCO software computed the usability value of this study. The researcher has no idea of the formula of the usability value since it is with SUMISCO. Problem statement 2 and the first hypothesis used one-way ANOVA. Presented in Table 4 is the result of the one-way ANOVA computation using the MS Excel add-in tool for statistics.

*Table 4*  
Significant Difference Result.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	655.6952	2	327.8476	3.345584	0.037155	3.039508
Within Groups	20284.79	207	97.99413			
Total	20940.48	209				

Based on Table 4, the value reveals that there is a significant difference in the usability of the adopted LMSs using the 5% significance level. This result rejects the null hypothesis formulated. This <http://worldconferences.net/home>

result only shows that the means of the 3 LMSs are not equal. To further compare differences of the LMSs and identify which among the LMS pairs have the significant difference, a post-hoc Tukey HSD test was used using an online calculator from <http://statistica.moood.com>. Table 5 shows the result.

*Table 5*  
Post-hoc Tukey HSD result of LMSs' usability difference.

treatments pair	Tukey HSD Q statistic	Tukey HSD p-value	Tukey HSD inference
A vs B	3.57390	0.03268	* p<0.05
A vs C	1.11080	0.69512	insignificant
B vs C	2.46310	0.19241	insignificant

The results in Table 5 present three different variables: A represents Edmodo; B represents Moodle, and C represents Schoology. The table reveals that only Edmodo vs. Moodle has a significant difference. This result notes that the usability of Edmodo once paired with Moodle provides a significantly different result. If wanting to compare the LMSs for future research, Moodle vs. Schoology, and Edmodo vs. Schoology could be better combinations for comparison since the usability means of the given pairs are equal.

### 6.3 Significant difference in the rating among the usability attributes of each LMS

The third problem statement was computed using an online calculator for statistics (Lowry, 2015). This calculator provided the result on one-way ANOVA and post-hoc Tukey HSD test. Another online calculator retrieved from <http://statistica.moood.com> confirmed the results generated. Table 6 shows the significant difference among the usability attributes' ratings of Edmodo.

*Table 6*  
Significant difference in the usability attributes' rating of Edmodo.

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	2298.989	4	574.7471	4.270332	0.002191	2.397828
Within Groups	46433.8	345	134.5907			
Total	48732.79	349				

Based on Table 6, the result reveals that the rating of Edmodo has a significant difference for p<0.05. This result shows that certain learning attribute causes a difference in the mean results of the usability attributes of Edmodo. A post-hoc Tukey HSD test was employed to determine which attribute pairs have a significant difference. Using this tool, the researcher placed in pairs the five usability attributes to determine which among these pairs provides a significant difference result. Table 7 presents the values.

*Table 7*  
Post-hoc Tukey HSD result with Edmodo.

Treatments Pairs	Tukey HSD Q statistic	Tukey HSD p-Value	Tukey HSD inference
A vs B	3.6677	0.073956	insignificant
A vs C	2.3387	0.4654119	insignificant
A vs D	0.1957	0.8999947	insignificant

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A vs E	1.4114	0.8387473	insignificant
B vs C	1.329	0.8717187	insignificant
B vs D	3.8634	0.0514336	insignificant
B vs E	5.0791	0.003442	** p<0.05
C vs D	2.5344	0.380897	insignificant
C vs E	3.7501	0.0636513	insignificant
D vs E	1.2157	0.8999947	insignificant

Table 7 presents five variables. These variables represent the usability attributes of the LMS. Variable A represents efficiency, B represents affect, C is helpfulness, D is Control, and E is Learnability. Based on the results, only the B vs. E grouping has significant difference result which means that affect and learnability provides a significant difference in the pairing of the results. This result provides an insight that significant difference on the usability rating of Edmodo was due to the two usability attributes: affect and learnability.

*Table 8*  
Significant difference in the usability attributes of Moodle.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	373.5029	4	93.37571	0.877402	0.477578	2.397828
Within Groups	36715.91	345	106.4229			
Total	37089.42	349				

The usability attributes' rating of Moodle on the otherhand presents a no significant difference based on p<0.05. This result implies that each usability attribute of Moodle was rated by students equally and presents an equal weight of getting the overall usability (see Table 8).

Table 9 presents the result of the one-way ANOVA test. Based on the values presented, there is a significant difference on the usability attributes' rating of Schoology at p<0.05. This result states that the mean scores of the usability attributes of Schoology are not equal. There is a certain usability attribute in Schoology that presents a significant difference.

*Table 9*  
Significant difference in the usability attributes' rating of Schoology.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	2240.103	4	560.0257	5.166942	0.000471	2.397828
Within Groups	37393.27	345	108.3863			
Total	39633.37	349				

To further evaluate which among the usability attributes is greatly making a difference, a post-hoc Tukey HSD test was employed. Same with Edmodo's treatment, the usability attributes were paired for evaluation. Table 10 shows this result.

*Table 10*  
Post-hoc Tukey HSD result with Schoology.

Treatments Pair	Tukey HSD Q statistic	Tukey HSD p-value	Tukey HSD inference
A vs B	3.43270	0.1106247	insignificant
A vs C	2.50280	0.3943482	insignificant
A vs D	1.14810	0.8999947	insignificant
A vs E	1.76800	0.6960992	insignificant
B vs C	0.92990	0.8999947	insignificant
B vs D	4.58080	0.0114362	* p<0.05
B vs E	5.20070	0.0025221	* p<0.05
C vs D	3.65080	0.0762167	insignificant
C vs E	4.27080	0.0226524	* p<0.05
D vs E	0.62000	0.8999947	insignificant

Based on the results presented in Table 11, there are three groups that provided a significant difference in the usability of Schoology. These groups include B vs. D, B vs. E and C vs. E. Considering the same variable association with Table 7, the associated usability attributes are affect vs. control, affect vs. learnability and helpfulness vs. learnability. These results present an idea that efficiency is not affecting the difference of mean scores in any usability attributes of Schoology. Furthermore, the result implies that the four variables: affect, control, learnability, and helpfulness influenced the result.

## 7. CONCLUSION AND RECOMMENDATIONS

### 7.1 Conclusion

This study aimed at identifying the most usable LMS, determining the significant difference on the rating of each usability attribute among the different LMS and determining the significant effect of the usability attributes' rating on the usability of each LMS. Based on the result, the first problem statement reveals that Edmodo has the highest value. This value means that among the 3 LMS, Edmodo is better in usability compared to Schoology and Moodle as perceived by students. The second problem statement presents a no significant difference which means that the 3 LMS were perceived to be of almost the same usability rating considering the five usability attributes. The third problem statement presents a significant difference on the rating of Edmodo, Moodle, and Schoology. The result reveals that the rating of the usability attributes of Edmodo and Schoology post a significant difference. Moodle's usability attributes on the otherhand reveal a no significant difference.

Usability attributes are essential to the realization of an effective, efficient and usable LMS. By looking into each factor, future LMS developer could understand the required standards and factors of a learning management system. In the light of the administrators, the result on the most usable LMS could be their basis for choosing the right LMS tool for the institution since based on the result, there is a significant difference in the usability of the 3 LMSs.

### 7.2 Recommendations

Given of the results, the researcher recommends the following:

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- 1.) The administrators should implement an institutional policy encouraging faculty members to use LMS specifically Edmodo.
- 2.) The College of Information should conduct training on how to use LMS and properly integrate it into classroom instruction.
- 3.) Internet accessibility should be available to the entire university so that everyone could make use of the tool.
- 4.) Measure the effectiveness and efficiency of LMS to students and teachers.

### **Acknowledgment**

The researcher wished to thank the University of Negros Occidental – Recoletos for funding this research. The researcher also wished to thank Dr. Tad Kirakowski of HFRG for the research instrument and for processing the data gathered.

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Appendix A  
TRAINING PROPOSAL USING EDMODO.

Description: this training program was designed with an objective to improve the teaching and learning experience in the University of Negros Occidental-Recoletos. As ICT penetrate classrooms and as students are exposed to online media, teachers should find a way to adapt into these technologies. This training proposal is a response to the research conducted by the researcher. This training should be participated by the fulltime faculty members of the university.

Program Objectives:

At the end of the training program, teachers will be able to:

1. Use Edmodo in a blended mode of learning.

Program duration: 2 sessions, 6 hours per session

Trainer: Ms. Mehreen E. Dolendo to be assisted by the College of IT faculty members.

Grouping: Faculty members will be grouped based on their level of expertise. Each group will have a maximum of 20 participants.

Topics to be covered:

Day 1 - Morning

- Understanding blended teaching style and learning management systems

Working with Edmodo

- Setup: Teacher, student, and parent accounts
- Groups: Creating, organizing, and managing
- Discussions: Using notes and replies to initiate dialogue, and use of polls

Day 1 - Afternoon

- Library: Unlimited storage to organize and share resources
- Connections: Participating in global Communities and PLC Groups

Day 2 - Morning

- Assessment: Polls, quizzes, assignments, and Edmodo Snapshot
- Progress: Assigning grades, awarding Badges, gaining insight

Day 2 - Afternoon

- Educational Apps: Discovering and integrating content from the Edmodo Store