Abstract

E-Learning platforms have shifted the way educators around the globe are educating their students. Gone are the days of sitting in a classroom and taking notes, to now modern times where a student can simply log in to a LMS program and have all materials available. E-learning is a growing $100 Billion industry and by 2019, Guragain estimates that half of all universities class will be either blended or online courses (2016). Subsequently, studies like this research will attempt to investigate the success of the LMS Moodle. The University of Belize has an estimated 26% of courses are either utilizing the LMS Moodle in the form of a blended class or a full online course, with an estimated 5000 student body population. The University if Belize will outgrow their physical infrastructure, however, with LMS resources that will not be a problem as students will have greater option of taking online courses. This research provides an empirical test of an adaptation of DeLone and Mc Lean, success model in the context of the LMS Moodle. The model consisted of six dimensions, which are information quality, system quality, service quality, user satisfaction, use, and perceived net benefits. In addition, researchers added complementary technology as a dimension. The findings of this research indicated that respondents believe Moodle's information quality, system quality, service quality, user satisfaction, use, perceived net benefits and complementary technology are satisfactory. The dimensions were raked level 4-5. However, will the results showed acceptability of the dimension only the dimension of complementary technology majority of respondents score at the highest level of 6-7.

Keywords: Information System, Moodle, LMS, IS Success, Perceived Net Benefits, E-Learning.
Introduction

The evolution of technology has affected various aspects of our society, from the manufacturing industry, technological devices to the educational system. The advancement of technology has allowed for innovation in learning through open learning source platforms such as Moodle. Modular Object Oriented Dynamic Learning Environment (MOODLE) was developed as part of Martin Dougiamas PhD in Education thesis (Moodle, n.d). Moodle has introduced learning with technology, while synchronous learning was the standard. Open learning source platforms has revolutionized classrooms from synchronous to blended and online. Zakaria and Daud (2013) indicates, the role of a university has shifted from a provider of knowledge to a facilitator of an environment conducive to learning. Learning Management System has become a fundamental tool in universities globally, because it enables flexibility and provides a competitive advantage. Moodle is an Open Source Initiative, which is free, independent to distribute, and modify (Zakaria & Daud, 2013).

Literature Review

Moodle is the most popular used LMS, with an estimated 68 million users globally (Carrillo et.al, 2018). Moodle functionalities classification are divided into two groups: configured modules and external tools (Costes et. al, 2005). The Configured modules consists of assignments, workshops, quizzes, forums etc. While the external modules are blogs, questionnaire and wikis (Costes et. al, 2005). LMS such as Moodle are conducive to learning because it is user friendly and incorporated online materials to enrich the learning process (Zakaria et.al, 2013). Zakaria ET. Al (2013) believes that LMS increases universities competitive advantage through increased efficiency of teaching. In addition, Moodle enables greater accessibility of course content and materials. Virtual classrooms enable greater intake of students without expanding infrastructure.

In 2006, the University of Belize implemented the LMS MOODLE; with technology, UB introduced blended and virtual classrooms to assist both lecturers and student with the delivery of teaching materials. Currently an estimated 25% of courses administered at UB are utilizing Moodle (Faber. B (2019), E-Mail Communication. The University of Belize currently used both the configured and external functions of Moodle. The Configured function primarily utilized are assignments, test, quizzes and forums. While the external function utilized are the blogs and course surveys. Since the implementation of Moodle at the University of Belize, limited research exist, that test its success. However, data does exist on Moodle’s success at the University of Belize, and this research will both utilize qualitative and quantitative methods. This research will further test and analyze the success of Moodle within the University of Belize, since the student body is the primary end user of Moodle we will be focusing on student’s perspective.

William H. DeLone and Ephraim R. McLean developed the DeLone and McLean IS success model in 1992, which was modified. The D & M IS success model was developed to provide a complete understanding of IS success within the six dimensions which are related and commonly evaluated. The D & M has been considered the most influential success model of information system. The six common dimensions of information system success are information quality, system quality, service quality, system usage, user satisfaction and net benefits. However, researchers added complementary technology as an additional contract. Since, to utilized Moodle a device or computer is required and the device used can affect the delivery of Moodle.

Information quality seeks to test the quality of information, which is stored, produced, and deliver using the LMS (Moodle). The system quality seeks to evaluate the quality of the overall system. System Quality has both negative and positive impact of the overall delivery of the LMS. While service quality is both related to user satisfaction and the overall net benefits. Poor system quality can negatively affect a LMS and cause poor delivery of information. System usage is also related information, system, and service quality. The construct of user satisfaction is directly related system usage and the overall net benefits. Finally, net benefits directly evaluate how the end users perceived the benefits gain from using the LMS. Surjadjaja et al. (2003) believes that LMS are customize specifically to meet end user’s needs. While Santos (2003) suggest service quality is the primary determinant of a successful LMS.
Methodology

Introduction

This section will cover information regarding the research design, sample population, instruments and procedures used for data collection. Quantitative data will be collected with the use of a questionnaires distributed to 35 students at the University of Belize, Belize City Campuses with intentions to receive minimum of 33 completed forms. The research seeks to answer research hypothesis.

Research Design

Applied research “aims at finding a solution for an immediate problem facing a society, or an industrial/business organization, whereas fundamental research is mainly concerned with generalizations and with the formulation of a theory” (Kothari, 2008). Basic research, also called pure research or fundamental research, is scientific research aimed to improve scientific theories for improved understanding or prediction of natural or other phenomena (NSF). Hence, applied research was utilized with a questionnaire, which can be view in the Appendix section of this research.

To carry out this research, there were two approaches that we could have used the deductive approach and inductive approach. The deductive approach is “developing a hypothesis (or hypotheses) based on existing theory, and then designing a research strategy to test the hypothesis” (Wilson, 2010) or, simply developing theories and hypothesis that can be tested (Palailogos, G, (2018) Personal Communication. On the other hand, inductive research “involves the search for pattern from observation and the development of explanations – theories – for those patterns through series of hypotheses” (Bernard, 2011). The researchers utilized both since hypothesizes were developed and a literature review was also conducted, to examine what information is already existed regarding the IS Success of Moodle.

As we know, there are two major types of data used for research, qualitative and quantitative data. Qualitative data “inquires deeply into specific experiences, with the intention of describing and exploring meaning through text, narrative, or visual-based data, by developing themes exclusive to that set of participants” (Given 2008). Quantitative data is “the systematic empirical investigation of observable
phenomena via statistical, mathematical or computational techniques” (Given 2008). This paper follows both qualitative and quantitative data methods as it involves existing data and a questionnaire.

**Hypothesis**

**H1:** End Users believe the Information Quality provided by Moodle is satisfactory.

**H2:** End Users believe that System Quality is satisfactory.

**H3:** End Users believe that Moodle Complementary Technology Quality is satisfactory.

**H4:** End Users believe that Moodle Service Quality is satisfactory.

**H5:** End Users believe that Moodle provides User Satisfaction.

**H6:** End Users believe that Moodle provide satisfactory Net Benefits.

**Participants**

The sample population for this research were current students from the University of Belize, Belize City Campuses who utilized Moodle. The researchers’ used the convenience sampling method due to limitations that were experience while conducting this research.

**Instrument**

As stated, this research applied the quantitative method through a Questionnaire, and data was obtain through closed-ended questions designed with the Likert scale to indicate the level of Disagreeable to Strongly Agreeable. The responses were later analyze and was showcased using Tables, Charts and Diagram. In addition, the data was analyzed using Microsoft Excel

**Research Procedure**

The steps taken to obtain data:

1. The researchers obtained information through research using EBSCOHOST to explore any relevant data available LMS MOODLE.

2. Researchers also used information, which was available through the Annual Research for National Development Journals.

3. The researchers further went on to distribute 35 questionnaires, in hope of collecting 30 completed forms. Subsequently, researches collected 33 completed forms utilizing the convenience sampling method. Table 1 provides a breakdown of demographical information about respondents, and all information was collected to protect the respondent’s privacy.

4. Finally, all data was reviewed and analyzed and Tables, Diagram and Chats were created to make the information readable and understandable.
Data Analysis

Below are the seven constructs that represent the IS model of success generated by the questionnaire, which was administered to a sample size of 30 students at the University of Belize, Belize City Campuses. The average was then calculated for each section, consisting of Information Quality, System Quality, Complementary Technology Quality, Service Quality, User Satisfaction, Use & the Perceived Net Benefits. The responses were used to create charts, graphs and tables, which is shown below.

Basic research was conducted in the form of a Questionnaire, where our target goal was 30 students. However, researchers distributed 35 questionnaires with the intention of getting 30 completed. Researchers were fortunate to receive 33 total. The sample data below is a sample of the background information we collected.

The background data indicated most respondents were females and majority were between the ages of 19 to 25. They are believed to be second year UB students 1 – 4 years working experience.

Table 1: End Users characteristic.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Quantity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7</td>
<td>21.22%</td>
</tr>
<tr>
<td>Female</td>
<td>26</td>
<td>78.78%</td>
</tr>
<tr>
<td>Age:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 18</td>
<td>11</td>
<td>33.33%</td>
</tr>
<tr>
<td>From 19 to 25</td>
<td>14</td>
<td>42.42%</td>
</tr>
<tr>
<td>26 to 35</td>
<td>7</td>
<td>21.21%</td>
</tr>
<tr>
<td>36 plus</td>
<td>1</td>
<td>3.03%</td>
</tr>
<tr>
<td>Education:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 st Year</td>
<td>6</td>
<td>18.75%</td>
</tr>
<tr>
<td>2 nd Year</td>
<td>10</td>
<td>31.25%</td>
</tr>
<tr>
<td>3 rd Year</td>
<td>8</td>
<td>25%</td>
</tr>
<tr>
<td>4 th Year</td>
<td>9</td>
<td>28.13%</td>
</tr>
<tr>
<td>Work Experience:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 to 4 years</td>
<td>15</td>
<td>45.45%</td>
</tr>
<tr>
<td>5 to 10 years</td>
<td>9</td>
<td>27.27%</td>
</tr>
</tbody>
</table>
The first section deals with the quality of information the system provides, one respondent ranked it at a low score of 1 to 2. While five respondents ranked from 2-3, which also represent disagreeable. Three respondents chose the neutral option, which represents the 3-4 level. Overall 24 respondents chose some form of agreeable with 11 ranked at a level of 4-5, 7 respondents at a level of 5-6, and 6 responses at a level of 6-7. Therefore, we see the highest amount of respondents ranked it at either level 4-5, or 5-6, which tells us that the information that Moodle provides is acceptable however, recommendations can be made. See chart below.

![Information Quality Chart](chart.png)

**Figure 1: INFORMATION QUALITY**

The second construct asked respondents about the system quality itself and 1 respondents ranked it at the lowest level of 1-2. Five respondents ranked it at level 2-3, and 4 respondents ranked it at the neutral level 3-4. However, majority of respondents chose some level of agreeableness, which represented 23 individuals. Ten respondents choosing 4-5, and 8 respondents at 5-6, and only 5 respondents at a level of the highest-level 6-7. Therefore, from these results, we can see that system quality is acceptable; however, some improvements can be made to provide a better service quality. See chart below.

<table>
<thead>
<tr>
<th>11 to 15 years</th>
<th>5</th>
<th>15.15%</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 plus years</td>
<td>4</td>
<td>12.12%</td>
</tr>
</tbody>
</table>

Table 1: DEMOGRAPHIC BREAKDOWN
The third construct generated was using the average gathered from the section of the questionnaire that dealt with Complementary Technology. Complementary Technology refers to device utilized to access the LMS Moodle, this construct is important because faulty complementary technology can negatively affect how the LMS system is delivered. Figure 3 below indicates that 1 respondent rated CT at the lowest level of 1-2. While, 4 respondents rated it at level 2-3. In addition, 6 respondents chose the neutral option at level 3-4. However, most respondents chose agreeableness with 23, with 6 respondents at 4-5, 5 respondents and a level of 5-6, and 12 respondents rated the Complementary Technology at a level 6-7.
The fourth construct surveyed the Service Quality, which refers to the perception of service expected from the LMS support staff and the actual service provided. This is important because service quality affects the overall net benefit generated from Moodle. Zero respondents rated the service quality at level 1-2. Also 4 ranked it at 2-3. However, 10 respondents chose the neutral option, which is extremely high. Overall, 19 respondents chose various form of agreeable, with 12 ranked level 4-5, and 6 chose 5-6 and only 1 choosing the highest level of service quality at level 6-7. This chart indicates that the University of Belize needs to consider improving the Service Quality for the LMS Moodle.

![Service Quality Chart](chart.png)

**Figure 4: Service Quality**

The fifth construct refers to User Satisfaction, how satisfied are UB Students with the LMS Moodle. Moodle as we know is utilize to provide information regarding blended and online classes at UB. Since student’s choice is limited, the use of Moodle User Satisfaction is important, and can affect the perceived net benefits. The questionnaire indicated that 2 individuals rated their User Satisfaction at the lowest level of 1-2, 4 chose 2-3, 5 rated their level of User Satisfaction at 3-4. While, a total 22 individuals rated their User Satisfaction at some level of agreeability. With 11 individuals rated at level 4-5, and 9 individuals choosing to rate their User Satisfaction at level 5-6. In addition, 2 individuals chose to rate their User Satisfaction of the highest level of 6-7. This indicates that User Satisfaction is also acceptable, however some form of improvements needs to be made since only 2 respondents rank their User Satisfaction at the highest level.
The sixth construct centres on students' Use. Zero students rated their Use at 1-2, while only 2 students rated their Use at 2-3. While 6 respondents chose the level 3-4, and 12 respondents chose level 4-5. In addition, 8 respondents chose 5-6, and 5 respondents rated their Use at the highest level of 6-7. The majority of respondents ranked this construct at agreeable with a total of 25 respondents, which is extremely good given that fact that UB plans to provide more blended and online classes.
The seventh construct is the Perceived Net Benefits and the data indicated that zero respondents ranked their low at level 1-2. While, 5 responded that the level of Perceived Net Benefits was at level 2-3, also 5 respondents said the Perceived Net Benefits was at level 3-4. 11 responded that their level of Perceived Net Benefits to be at 4-5, and 10 responded at the level of 5-6. In addition, 2 respondents indicated the highest level of Perceived Net Benefits 6-7. The majority of responses with 23 rated their Perceived Net Benefits as agreeable which can be interpreted as a good sign.
The Figure 8 indicates the Average Response, which show case that the majority of respondents rated all sections as high. This is a good sign as the LMS Moodle can be utilize to assist Lecturers with the delivery of information for the various classes. The data can also be interpreted that the Perceived Net Benefits far outweighs any cost generated with the utilization of Moodle.
Conclusion

Discussion
Studies like this research “Calculating Moodle Success” will assist The University of Belize to gain a better understanding of Moodle from a student perspective and provides areas for improvements. In addition, it can be use by future researchers, since E- Learning and LMS are a growing aspects of education. Moodle is utilized in approximately 230 countries and currently has an estimated 156,021,810 users (Moodle, n.d). In addition, with the advancement of LMS Moodle a growing number of organization will need to evaluate its success to determine whether benefits outweigh cost. However, the multitude of independent variables that an LMS has is a primary issue to consider when evaluating.

The use of the DeLeon and Mclean IS Success model is dependent on the fact that calculating the success of any LMS is dependent on a multitude of variables and because variables can defer. “The D&M has been widely used to gauge success (for example, see Petter et al., 2008). Over time, the model has been modified to meet the requirements set by several kinds of information systems, and from different points of view. Later, DeLone and McLean” (Halonen et. Al.,2014). The constructs that the IS Success model utilizes were ‘Information Quality’, ‘Use’, ‘User Satisfaction’, ‘Individual Impact’ and ‘Organisational Impact’ and later modified to add system quality. While Individual impact and organizational impact was drop. These construct has provided standard variables to test any LMS success. With the utilization of the D & M researchers evaluated the LMS Moodle at the University of Belize, Belize City Campus.

Subsequently, the data collected indicates that students of the University of Belize, Belize City Campus believes Moodle is beneficial. Based on the constructs generated by the questionnaire Moodle deemed acceptable in regards to: information quality, system quality, complementary technology, service quality, user satisfaction, use and perceived net benefits. However, improvements are recommended, since limited respondents chose to agree at the highest level of 6-7. The average responses were above level four, which is consider acceptable. In addition, the perceived net benefits respondents ranked it high. This can be interpreted, as respondents believe they benefit from utilizing Moodle.

Limitations
Limitations experienced by researchers in conducting this research are as follows:

There were a few significant limitation associated with carry in out this research. The first limitation was the lack of access of available data both local and international. Secondly, time constraints the researchers was unable to gather sufficient information. In addition, availability of students to complete the questionnaire, as most felt they were too busy to complete, therefore the researchers utilize the convenience-sampling method. Finally, because the sample population was small, this research would not reflect a true representation of the total population.

Recommendation
Researchers recommend that future research be conducted on Moodle IS Success for future study in order to decrease the level of errors drawn in the study. It is recommended that the sample size be increase to a number that is representative of the population.

Conclusion
The main purpose for conducting this research was to measure the IS Success of the Moodle system in the context of the University of Belize, Belize City Campus. The need for a computerized platform such as the Modular Object Oriented Dynamic Learning Environment cannot be overemphasized. The basis of Moodle is to provide a free learning platform, geared towards the delivery of effective teaching material. Therefore to measure the level of success associated with Moodle, the IS Success model was developed
based on the DeLone and McLean (2003) Information System Success: A Ten Year Update. The results indicate that all the pretested constructs that was selected are valid measures of Moodle IS Success rate. As previously mentioned these constructs are information quality, system quality, service quality, use, user satisfaction, complementary technology quality and perceived net benefits. From the data analysis, it can be seen that most of the respondents from the sample group believes that the Moodle provided respondents with satisfactory information quality, system quality, service quality, use, user satisfaction, complementary technology quality and perceived net benefits. However, it is important to note, that some respondents from the chosen sample did not agree with the overall findings. Based on their feedback some improvements that can be made to the Moodle are: end users should be able to log errors when they occur. Future more, online courses should be open where end users are not limited to a specific in class time. Administrators of the system should have a real go at your own pace online courses.
References


Appendix A

Questionnaire: Calculating Moodle Success (STUDENTS PERSPECTIVE)

**Purpose**
This research is a requirement for the course CMPS3012 MIS at the University of Belize University. The primary objective of this questionnaire is to test the reliability of the Learning Management System (MOODLE), which is utilize by Faculty and Students at the University of Belize in the delivery of information resources to students.

This questionnaire will cover basic information about yourself and the Learning Management System Moodle. All data gathered are confidential and will be analyzed to determine the success of Moodle at our University.

Please answer each question based on your experience with Moodle.

**Instructions**
Please tick the boxes to mark your answers.

<table>
<thead>
<tr>
<th>1. Background Information</th>
<th>Answers:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please indicate your gender:</td>
<td>Male □ Female □</td>
</tr>
<tr>
<td>Please indicate your age:</td>
<td>&lt;25 □ 25-35 □ 36-45 □ 46-55 □ &gt;55 □</td>
</tr>
<tr>
<td>Please indicate highest education level attained:</td>
<td>Masters □ Bachelors □ Associates □</td>
</tr>
<tr>
<td>Please indicate the year you are currently in at University of Belize:</td>
<td>1st Year □ 2nd Year □ 3rd Year □ 4th Year □</td>
</tr>
<tr>
<td>Please indicate the number of years working:</td>
<td>&lt;5 □ 5-10 □ 11-15 □ &gt;15 □</td>
</tr>
</tbody>
</table>

Indicate your agreement with each statement by rating it from (1) strongly disagree to (7) strongly agree.

<table>
<thead>
<tr>
<th>2. Information Quality</th>
<th>Disagree --------------------------- Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQ1: The Moodle system provides information that is exactly what you need</td>
<td>1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □</td>
</tr>
<tr>
<td>IQ2: The Moodle system provides information you need at the right time</td>
<td>1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □</td>
</tr>
<tr>
<td>IQ3: The Moodle system provides information that is relevant to your class</td>
<td>1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □</td>
</tr>
<tr>
<td>IQ4: The Moodle system provides sufficient information</td>
<td>1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □</td>
</tr>
<tr>
<td>IQ5: The Moodle system provides sufficient information that is easy to understand</td>
<td>1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □</td>
</tr>
<tr>
<td>IQ6: The Moodle system provides up-to-date information</td>
<td>1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □</td>
</tr>
<tr>
<td>IQ7: The Moodle system provides sufficient information</td>
<td>1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □</td>
</tr>
</tbody>
</table>
### 4. Complementary Technology Quality

| CTQ1: The computer (desktop, laptop, mobile device) you normally use to access Moodle is adequate | 1 2 3 4 5 6 7 |
| CTQ2: The computer (desktop, laptop, mobile device) you normally use to access Moodle has a fast and reliable internet connection | 1 2 3 4 5 6 7 |

### 5. Service Quality

| SV1: The support staff keep the Moodle system software up to date | 1 2 3 4 5 6 7 |
| SV2: When users have a problem the Moodle system support staff show a sincere interest in solving it | 1 2 3 4 5 6 7 |
| SV3: The Moodle system support staff respond promptly when users have a problem | 1 2 3 4 5 6 7 |
| SV4: The Moodle system support staff tell users exactly when services will be performed | 1 2 3 4 5 6 7 |

### 6. User Satisfaction

| US1: Most of the users have a positive attitude of Moodle. | 1 2 3 4 5 6 7 |
| US2: You think that the utility of the Moodle system is high. | 1 2 3 4 5 6 7 |
| US3: The Moodle system has met your expectations. | 1 2 3 4 5 6 7 |
| US4: You are satisfied with the Moodle system. | 1 2 3 4 5 6 7 |

### 7. Use

| U1: Your frequency of use of the Moodle system is high | 1 2 3 4 5 6 7 |
| U2: You depend upon the Moodle system | 1 2 3 4 5 6 7 |
| U3: You were able to complete a task using Moodle even when there was no one around to tell you what to do | 1 2 3 4 5 6 7 |
| U4: You have the knowledge necessary to use the Moodle system | 1 2 3 4 5 6 7 |

### 8. Perceived Net Benefits

<p>| NB1: The Moodle system helps you improve your academic performance | 1 2 3 4 5 6 7 |
| NB2: The Moodle system helps students save costs | 1 2 3 4 5 6 7 |
| NB3: The Moodle system helps you achieve your academic goals | 1 2 3 4 5 6 7 |
| NB4: Using the Moodle system improves assessment and teaching | 1 2 3 4 5 6 7 |
| NB5: Using the Moodle system at school increases your academic productivity | 1 2 3 4 5 6 7 |</p>
<table>
<thead>
<tr>
<th>NB6: Overall, using Moodle enhances student performance</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>

Please return this survey to the person who gave you the form.

Thank you for your participation.