An Empirical Study: A Success Story of Effectiveness of an OLE

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Key words: Learning Management System (LMS), Learning Evaluation Questionnaire (LEQ), Learning Styles Questionnaire (LSQ)

Abstract

This paper presents the results of an empirical study conducted with students following a distance education program. In the study questions posed were whether students could perform well in examinations using only the Learning Management System (LMS), whether they could use it in an efficient way and whether there was a relationship between students' learning styles, number of LMS hits and learning achievements.

Students were given access to a specially designed course section. The students’ learning achievements were evaluated in two tests at different intervals. The study data were gathered using questionnaires and LMS statistics.

We found that once the students got acquainted with the environment they could use the LMS more efficiently and managed to get high scores by only using the LMS. Results associated with the learning style preferences imply that we have designed the learning content and the environment to support learners with different learning style preferences.

1 Introduction

The term ‘e-learning’ was introduced around 2000 by Jay Cross, the Founder of the Internet Time Group [16]. Since then researchers have been carrying out projects to find the applicability and usefulness of e-learning in distance educational programmes. Today it has become a business rather than a service. Woodill [41] says that the literature reporting failures of e-learning practices is on a rapid increase in the 21st century. The main reason for this is that the course developers do not consider how people learn in designing their courses [4]. In online learning environment(OLE)s, creating of instructional material is considered as one of the main duties of the teacher. Garrison and Anderson [13] support this reasoning by saying; a teacher is responsible of designing and creating educational activities. Also Sherry [34] emphasises the importance of having skill and knowledge of instructional design for teachers. But teachers may not be good instructional designers. Also, if teachers try to create interactive e-learning content by themselves it can cause a burden for the teachers at least at the beginning of the programme.

However the idea of introducing e-learning as a method of delivering lessons to students has also proven to be beneficial to both teachers and students. According to Gentilucci [14], the teacher should be freed from the pressure of being the only source of information and instead he should be a facilitator in supporting and guiding the learner to use online learning content. Besides that using e-learning in teaching creates opportunities for the students to do studies in a different way which makes learning more student-centred and personally interactive [2]. Therefore it is important to get the students feedback after introducing e-learning to any distance education programme. Students’ satisfaction of the online learning programme is considered as the major driver for the success or failure of such medium [20]. The satisfaction
of the OLE depends greatly on the learners’ attitudes and experience gained by using the OLE. Ecom, Wen and Ashill [10] report that course structure, self-motivation, learning styles, interaction and facilitation influence students’ satisfaction. Swan et al. [36] had done a study in the USA where students are quite familiar with technology enhanced learning environments and report that their students were highly satisfied with their instructor-driven learning setting. Lupo and Erlich [23] had used an OLE with some face-to-face tutoring meetings at the beginning of the course and report that their course was successful in terms of students’ satisfaction and perceived learning. However, in practice there are lots of students in a distance education programme and it is not possible to gather them all and conduct face-to-face learning sessions or to provide individual attention by instructors in the OLE.

Different learners have different learning styles and it is important to know students’ learning styles for course design and delivery [3]. Because learners’ learning style preferences can be a major factor which influences the effectiveness of any learning programme [19]. Valenta et al. [38] concludes that there is a need for future research to understand the relationship between learning styles and learning experience of online learners. Existing literature reports different conclusions on how students with different learning styles use OLEs for their studies (e.g. [9], [32], [25], [22], [31]). Therefore, we were motivated to find whether there is a relationship between students’ satisfaction, learning achievements and learning styles in an OLE.

The effectiveness of the OLE for the learners implies how helpful the learning environment is for the students to achieve the learning objectives. Therefore, in this study the effectiveness of the OLE was measured with students’ learning achievements. Successfulness of the OLE was measured with students’ satisfaction and effectiveness of the OLE. Liaw, Huang and Chen [21] consider ‘instructor-led learning environment’ as one of the main characteristics of an efficient e-learning environment. However, the study of Sabry and Baldwin [31] demonstrated that learner’s interaction with the learning content was more useful than other interactions that took place in a web-based learning environment. Therefore, our effort was to find out whether students could successfully learn only using an OLE where they would find less instructor involvement but more learner-content interactions. The study was conducted in a country where students have less computer facilities and poor network bandwidth [15].

1.1 Online Learning Environment (OLE) for BIT Undergraduates:
University of Colombo School of Computing (UCSC) in Sri Lanka provides interactive online learning content to the Bachelor of Information Technology (BIT) degree program (www.bit.lk) through its Learning Management System (LMS) at www.lms.bit.lk. BIT is an external degree programme where students do not get any lectures from their respective course coordinators of the BIT programme. But there are private institutes who conduct courses based on the BIT curriculum. UCSC is having a separate team with instructional designer (ID)s to design and develop e-learning content. Course teachers are supposed to provide their teaching materials or notes to the IDs and support them by checking the product at different intervals to verify the subject matter [39].

Learning through an LMS is quite new to the 1st Semester students of BIT who come from Sri Lankan schools where the main method of training is face-to-face teaching. Therefore, UCSC needs to create an OLE where learners will find what they really need to do their studies well and consequently increase pass rates of the BIT degree programme.

1.2 Factors Affecting e-Learning
As Stolovitch and Keepes [35] describe, there are three major factors; ability to learn, prior knowledge and motivation that influence how much and how well humans learn. In an OLE the learners can study on their own time tables and they can select activities or lessons as they want. Therefore, when the system is providing them learning content with appropriate
instructional design methodology [30] the adult learners can get the maximum benefit of learning independent of their learning ability. But for that, learners with less learning abilities should be highly motivated and hard working. Motivation for learning is affected by three major factors; value, confidence and mood [35]. Therefore, it is important to know whether students value the OLE, how confident they are to use the LMS and whether the students have positive expectations putting them in a good mood for learning.

There are some negative factors which hinder students scoring high marks at the examinations even if they study diligently. Personal factors like work load of the job and distressed home environment are some of the main negative influences of e-learners [5]. There are many other negative factors which ultimately trouble learners’ mind and badly influence their learning.

Different learners have different learning styles which are students’ preferred methods or modes of learning [27]. Understanding of learning style preferences of students help to design courses to facilitate learning of individual students [28]. There are different types of learning style instruments to find the learning styles of students. The Learning Style Questionnaire (LSQ) is one such learning style instrument which is developed by Peter Honey and Alan Mumford based on Kolb’s learning style theory [6]. According to Allinson’s and Hayes’s [1] comment the LSQ is a relatively more reliable instrument than Kolb’s Learning Style Inventory. The LSQ has been used and tested by many researchers and commented as a valid and reliable learning style questionnaire (e.g. [26], [1] and [11]). Honey [18] has reported that a 40-items version of the LSQ is designed for young learners who are not in managerial roles. The majority of the BIT students who participated in this study belong to the age group of 20-25 years. Therefore, in the present study we used Peter Honey’s and Mumford’s 40-item LSQ to identify the students’ learning style preferences.

The LSQ describes learners with respect to four learning styles; Activist, Theorist, Reflector and Pragmatist. According to the explanation given on the LSQ [18];

Activists like to learn by doing. They like to take challenges and experience new things. They want to try out exercises or participate in activities without thinking of the consequences.

Reflectors learn by observing and thinking about what happened. They listen carefully to everyone, think over all ideas and repeat the learning when they get a chance to do it.

Theorists like to see concepts, models and the overall image of the lesson. The content needs to be presented in an order and explained from the simple things to details.

Pragmatists learn best when they are given a chance to practice what is immediately demonstrated or explained. They enjoy experimenting with new ideas.

1.3 Aim of the Study

After introducing the LMS to the BIT students, UCSC observed an improvement in pass rates and an increment in the number of self-study students [12]. The increase in pass rates and number of self-study students could be taken as a sign of the students being satisfied with the e-learning environment, but we do not know to what extent and more specifically regarding what particular features of the environment they are satisfied with. This motivated us to more closely investigate whether;

1. students are satisfied with the OLE,
2. students can perform well in examinations if they use only the LMS for their studies,
3. students can use the OLE in an efficient way and
4. whether there is a relationship between students’ learning styles, online learning content access records and their learning achievements.
2 Methods

2.1 Participants:
The study was done with a sample of students who sat the 1st semester exam of the BIT degree programme at the UCSC in March 2008. The 1st semester started in October 2007 and the LMS was available for them from the last week of October 2007. There were 2526 students who got registered to the 1st semester.

In December 2007, 120 students of BIT semester 1 were selected to do this study by considering the number of LMS hits done by each student and their residential province. All the students were novice e-learners and none of them had experience in using a Learning Management System (LMS) for learning before joining with the BIT degree program. The students participated in this study while following the other courses in the semester. The selected students were not isolated or grouped in the LMS.

The study included three face-to-face meetings with the students. Only 40 students participated in the 1st meeting to start the study. However, only 27 students participated in all 3 meetings and the group was formed of 18 males and 9 females. The majority of the students belong to the age group of 20-25.

2.2 Material:
Online Learning Content: The selected course section for this study dealt with a rather practical subject. The interactive learning contents of the course section were designed and developed by the 1st author of this paper and uploaded to the LMS. The learning contents were designed considering ‘how people learn’ and ‘the nature of the knowledge’ [17]. For example, different presentation methods were used in designing instructional messages with concepts and facts. Text was used to introduce the key words in the lesson.

Activities were included where appropriate providing more chances for the students to learn by doing. Most of the activities led to forum discussions creating collaborative learning environments for the learners. The students could upload their answers to the activities and discuss with others via forums, a chat room or the private message facility in the LMS.

A Practice Quiz was provided on the LMS for the learners to practice answering to a set of multiple choice questions based on the content of the course section.

Students’ Learning Achievements: We used two test papers; Test 1 and Test 2 to evaluate students’ learning achievements. The duration of each test paper was 30 minutes and each consisted of set of multiple choice questions. The questions in Test 1 covered the first three sub-sections and Test 2 covered the rest of the sub-sections of the target course section appearing on the LMS.

Questionnaires: Two different types of questionnaires were used in this study.
1 LSQ: Learning Style Questionnaire obtained from Peter Honey and Mumford publications- Students rated a set of 40 statements. Each statement asked whether the student agreed or disagreed with it.
2 LEQ (Learning Evaluation Questionnaire): A questionnaire based on the Tests and the studies on the LMS - The LEQ consisted of questions on a Likert Scale, dichotomous questions, filter or contingency questions and unstructured or open-ended questions which made the students to write any comments freely. The questions concerned students’ general attitudes regarding online learning, specific attitudes about the OLE in the LMS and how helpful the LMS was for the student to answer the test.
2.3 **Design of the Study:**
We did our study in the middle of the 1st semester. It was the best time to do this study because by that time the students had had enough time to get familiar with the LMS and none of the private institutes had started teaching the course section we selected. Conducting the study at that time helped us to make students’ participating in the OLE mandatory for their learning. Thereby we could assume that the students’ learning achievements measured through the tests were not gained from a formal classroom environment.

A random sample of 120 students was selected for this study considering their place of residence and how often they access the LMS. The study was done in three meetings (Figure 1) and only 40 students participated in the 1st meeting. Even though it was a small group with respect to the total number of registered students, it represented students from all major provinces of the country.

There was no comparison group for this study. As one of our aims was to find out whether students can study efficiently only using the LMS, we attempted to control the variables of students’ getting any face-to-face teaching during the study period and having prior knowledge of the subject matter.

### Figure 1

![Diagram](image)

**LSQ**

2.4 **Procedure:**
The study was done in three weeks with three face-to-face meetings. At the 1st meeting, the LSQ was distributed. The meaning of each statement in the questionnaire was simplified to make the students clearly understand before answering the questionnaire. Students answered the questionnaire independently. The purpose of the meeting and the plans for the future meetings were explained and the students expressed their willingness and possibilities to participate in future meetings.

Interactive learning content for sub-sections of the lesson were uploaded to the LMS at a weekly basis. Forums to discuss the subject matter were made available with the interactive learning content. Students were informed of the course updates through e-mails.

There were two tests; Test 1 and Test 2. Test 1 was conducted at the 2nd meeting and Test 2 was conducted at the 3rd meeting. The students were given 1 week of study period before each test. The students who expressed their willingness to participate in the future meetings were invited for the meetings. Students filled in the LEQ and participated in the debriefings on each day after the test.

3 **RESULTS**

3.1 **Results of the LEQ and the Debriefings:**
The questions rose in the LEQ were categorized into focal areas of the study. Students’ answers for the questions on the Likert Scale were represented with 10, 5, 0, -5 and-10 in the order of most positive to most negative attitudes or experiences. The average and the standard deviation (SD)s of those values are presented in Table 1.
Table 1: Results of the LEQ of the 2nd & the 3rd meetings

<table>
<thead>
<tr>
<th>Practical capability to do</th>
<th>2nd Meeting</th>
<th>3rd Meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have a possible Internet access point</td>
<td>7.14</td>
<td>8.33</td>
</tr>
<tr>
<td>Often Use OLE</td>
<td>5.48</td>
<td>5.95</td>
</tr>
</tbody>
</table>

General attitudes gained by experiencing the OLE

| Usefulness of e-learning material           | 8.10        | 8.10        |
| Confidence in using the OLE                | 6.19        | 7.14        |
| OLE solves problems                        | 2.86        | 7.14        |
| Can learn successfully only using the OLE  | -1.43       | 0.95        |

Factors affecting the score of the test result

| Could easily discuss my problems            | 1.19        | 3.10        |
| Helpfulness of OLE to score in test        | 5.00        | 7.62        |
| Did not get any support from a f2f environment | 2.38    | 3.57        |
| Did all the activities                      | -1.43       | 3.33        |
| Did not have prior knowledge               | 7.62        | 7.62        |

Specific attitudes regarding online learning content

| Content was easy to understand              | 10.00       | 10.00       |
| Did not need someone to explain             | 5.24        | 6.19        |

Problems

| Any learning difficulties                   | 0.48        | 10.24       |
| Speed of the reading skill                 | 2.86        | 4.76        |
| Had to do more activities                  | 6.19        | 8.57        |

According to the results in Table 1, when moving from the 2nd meeting to the 3rd meeting the students’ experiences and attitudes towards the OLE have positively increased. However, more learning difficulties have reported at the 3rd meeting than at the 2nd meeting. According to the explanations provided on the LEQ and debriefing the students had faced some technical problems in accessing the activities with heavy graphics and animations. A plausible interpretation is that during the week before the 3rd meeting our students might have motivated to go through all the content in the OLE. Results of the debriefings report that the learning contents used in this study were more interactive and had more activities but the standard and quality were almost same as what they found in other courses in the LMS.

3.2 Relationship between the Number of LMS Hits and the Test Scores:

We considered number of LMS hits done by the students and their respective tests scores in order to find how much our students have used the LMS in reality.

Table 2: LMS accesses during the week before the 2nd meeting and Test 1 scores

<table>
<thead>
<tr>
<th>Number of Students</th>
<th>Range of Test 1 Scores</th>
<th>Number of Sub Sections</th>
<th>Learning Content Views</th>
<th>Activity Records</th>
<th>Quiz Views and Attempts</th>
<th>Total No. of Hits</th>
<th>SD of Total No. of Hits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>50-45</td>
<td>3</td>
<td>38</td>
<td>37</td>
<td>7</td>
<td>81</td>
<td>54</td>
</tr>
<tr>
<td>2</td>
<td>44-40</td>
<td>3</td>
<td>81</td>
<td>13</td>
<td>11</td>
<td>104</td>
<td>13</td>
</tr>
<tr>
<td>6</td>
<td>39-35</td>
<td>3</td>
<td>52</td>
<td>18</td>
<td>14</td>
<td>84</td>
<td>62</td>
</tr>
<tr>
<td>7</td>
<td>34-30</td>
<td>3</td>
<td>48</td>
<td>35</td>
<td>8</td>
<td>91</td>
<td>71</td>
</tr>
<tr>
<td>3</td>
<td>29-25</td>
<td>3</td>
<td>47</td>
<td>30</td>
<td>3</td>
<td>80</td>
<td>30</td>
</tr>
<tr>
<td>1</td>
<td>24-20</td>
<td>1</td>
<td>16</td>
<td>3</td>
<td>9</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>19-0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3: LMS accesses during the week before the 3rd meeting and Test 2 scores

<table>
<thead>
<tr>
<th>Number of Students</th>
<th>Range of Test 2 Scores</th>
<th>Number of Sub Sections</th>
<th>Learning Content Views</th>
<th>Activity Records</th>
<th>Quiz Views and Attempts</th>
<th>Total No. of Hits</th>
<th>SD of Total No. of Hits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>50-45</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>44-40</td>
<td>2</td>
<td>39</td>
<td>43</td>
<td>16</td>
<td>156</td>
<td>73</td>
</tr>
<tr>
<td>5</td>
<td>39-35</td>
<td>2</td>
<td>57</td>
<td>45</td>
<td>8</td>
<td>163</td>
<td>49</td>
</tr>
<tr>
<td>8</td>
<td>34-30</td>
<td>2</td>
<td>44</td>
<td>14</td>
<td>9</td>
<td>91</td>
<td>46</td>
</tr>
<tr>
<td>3</td>
<td>29-25</td>
<td>2</td>
<td>63</td>
<td>8</td>
<td>5</td>
<td>89</td>
<td>20</td>
</tr>
<tr>
<td>1</td>
<td>24-20</td>
<td>3</td>
<td>42</td>
<td>0</td>
<td>0</td>
<td>42</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>19-0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The total number of LMS hits was calculated by adding the number of hits done to access the learning content, forums and the Practice Quiz. The forum access records were considered as activity records of the students. The results are presented in average values and standards deviation (SD)s in Table 2 and 3. The tests scores in Table 2 and 3 are on normal distributions and they imply that the two tests were of equal level of difficulty. Comparatively, SD values of total number of LMS hits of Test 1 are higher than that of Test 2. Also, there is no relationship between Test 1 scores and number of LMS hits in Table 2. However, the results of the Test 2 show an increase in the test score with the average number of LMS hits.
To identify the relationship between the number of hits in the LMS and Test results clearly, we prepared the best fit exponential curves (Exponential Regression Curve) with the test results and the total numbers of LMS hits during the week before the tests. The results of Test 2 imply that there is a positive relationship between the test scores and the numbers of LMS hits. Records of all the students except 8 fall close to the regression line.

When moving from Test 1 result to Test 2 there is a decrease in the number of points lying out of the regression curve. This can be interpreted as in the future we may be able to predict students’ learning achievements by observing their LMS access records.

3.3 Relationship between Learning styles and other variables:
The results of the LSQ reports, that there were 11 Activists, 7 Reflectors, 4 Pragmatists and 6 Theorists in our sample. Among them there were 4 students with Reflectors and Theorist both LSPs. 1 with Reflectors and Pragmatists both LSPs. 1 with Reflectors, Theorist and Pragmatists LSPs. 6 students showed more than one LSP but none had all four LSPs.

There was no significant relationship between learning style preferences, LMS hits and test scores. However, by analysing individual learning style preferences, we found that learners with different types of learning style preferences are there among the students who have scored 30 or more and among the students who have done more than 70 hits in the LMS.

4 Discussion

Our study was based on a rather practical subject and its learning objectives were targeting at skills and factual knowledge. Turner-Bisset [37] says that the courses which target at complex amalgams of concepts, factual knowledge and skills cannot be successfully taught in e-learning media. The study of Piccoli et al. [29] with a virtual learning environment reports a decline of students’ satisfaction during a semester. However, in this study we found that once the students got familiar with the OLE their attitudes towards the OLE changed from rather negative to more positive. Also, results of the LEQ reported that once students got used to the OLE they found that they could easily discuss problems, they did not need support from a face-to-face environment, they were motivated to complete all activities and OLE helped them to score well in the test. These results implied that the students were quite satisfied with the OLE and its content. Hence the results of the present study on students’ satisfaction with the OLE comply with the conclusions done by Lupo, Erlich [23], Motiwalla and Tello [24].

Cavanaugh [7] advises that educators who plan to implement distance education should not expect any difference in academic performance as a result. However surprisingly the results of this study reported that the students could use the OLE effectively in their studies and they could score well by only using the OLE. Also, during the study period students needed less support from the instructor or the course coordinator. This may support the conclusion made by Sabry and Baldwin [31] who reported that learner’s interaction with the learning content was more useful than other interactions taken place in a web-based learning environment. Moreover, the results of this study imply that our OLE had equally supported students with different learning style preferences and it supports the conclusion made by Lu et al. [22] who reported that their students could learn equally well in a WebCT-based MIS course irrespective of their different learning styles.

The results obtained in the debriefing reported that the course section used in this study was designed in the same quality and standard of other courses in the LMS. As the instructional designers of UCSC work according to the advice and guidance of course teachers, we can assume that if we used the learning content designed by them, we might have achieved at least somewhat close results to the results of this study. Hence, that may contradict Garrison’s and
Anderson’s [13] reasoning and we would like to emphasize that the teacher is not the only one who is responsible in designing and developing effective and efficient e-learning content for distance learning programmes. Also, contradicting Sherry’s [34] reporting we would like to add that it is not essential to have skills and knowledge of instructional designing for the teachers of distance online learning courses.

5 Limitations and Future work

There were some methodological limitations to this study. Firstly the size of our sample was not enough to group students in four learning styles having a significant number in each. According to the nature of the BIT programme it was not easy to make a large number of students to participate in a series of workshops and we had to accept the number of students willing to spend their time with us.

Secondly, there could be other variables explaining individual’s learning ability which would have helped to explain the student’s behaviours of those that showed deviations from the expected behaviours. But measuring of outcomes for these types of variables is problematic in nature [8].

Thirdly, the coordinator of the course selected for this study and the main researcher was the same person and that might have influenced self-reports of the students. But on the other hand that supported us to prepare test questions with the same standard as of the final test.

The results of this study motivated us to further investigate the instructional design methodology we used in this study to make this work successful. The online learning content and the environment can be further improved with student’s suggestions and a more specific study can be conducted to find out how effective each and every component of the LMS content is.

6 Acknowledgement

This study is funded by a SIDA granted project. Our special thanks would be bestowed to the staff at the BIT External Degree Centre and the e-Learning Centre of UCSC for providing us support and necessary information to do this study.

7 Conclusion

This study was done with a distance education program. The aim of the study was to find whether students were satisfied with the online learning content and its environment, whether they could efficiently learn only using the OLE and whether we had successfully designed the OLE associated with the LMS and whether there was a relationship between learning styles, LMS hits and Test scores. The study reported that the students’ satisfaction towards the OLE increased gradually and the students could use the OLE more efficiently in their studies once they got acquainted with the OLE. The study results suggest that in the future we may be able to predict students’ learning achievements by observing their LMS access records. The change of students’ attitudes towards the learning content and the environment from slightly negative to more positive implies that we have successfully designed the learning material and the environment. Further, students’ self-reports give witness to that the quality and the standard of the content of the OLE is the same as the other courses on the OLE implying that online distance educational courses can be designed and developed without giving an extra burden to teachers. Even though we could not find any relationship between students’ learning style preferences, LMS hits and test scores the results obtained imply that we have designed the
learning content and the environment to support learners with different learning style preferences.

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