Determinants of Satisfaction and Deep Structure Usage of Post-acceptance Learning Management Systems by Malaysian Higher Education Lecturers

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***Abstract*—This study investigates factors influencing satisfaction and deep structure usage of Learning Management Systems (LMS) using a revised expectation-confirmation model of information system continuance. It addresses the gaps in the existing literature that primarily focused on behavioral intention in the acceptance stage instead of deep structure usage in the post-acceptance stage.**

Deep structure usage refers to using LMS features to support an underlying teaching task. The study population consists of 54 lecturers in Malaysian private universities in the post-acceptance stage of LMS implementation. Data was gathered using a web-based survey questionnaire. Various variables were analyzed through statistical correlation and regression using a statistical package for social science software. This study concludes that confirmation of expectation and perceived usefulness positively impacted satisfaction; confirmation of expectation was the strongest predictor of satisfaction. Additionally, the combined effects of satisfaction, confirmation of expectation, and perceived usefulness positively correlated with deep structure usage of LMS. This study investigates whether lecturers would use the system to its full capacity if they found the LMS features useful to a specific teaching task and if the system provides satisfaction and fulfills the lecturers' expectations. Future research recommends extending the model to investigate determinants of satisfaction and confirmation of expectations of specific LMS features in terms of technical, design, capability, and experiential aspects. This extension would enable a more detailed understanding of aspects that determine satisfaction and confirmation of expectation, directly influencing deep structure usage.

***Index Terms*—Deep structure usage, learning management system, perceived usefulness, satisfaction.**

I. Introduction

A. Background

Higher learning institutions incorporated Information and Communications Technology (ICT) into their teaching and learning processes in Malaysia to stay competitive and meet the needs of students who are becoming more technology-dependent and technology-literate [1]. Therefore, the learning method shifted from having a confined classroom space with students and lecturers physically present to unlimited virtual space. The move to using virtual learning space has become more apparent, particularly during the recent COVID-19 pandemic where university and school classes have switched to online meeting platforms, such as Zoom and Learning Management Systems (LMS).

One of the benefits of adopting technology in education is evolving teacher-centered education into a learner-centered approach [2]. This approach empowers students to be responsible for their learning, with lecturers as facilitators instead of teachers. Other studies have highlighted more benefits, such as the cost savings impact of adopting ICT [3] and the democratization of education [4]. Moreover, technology also enables materials to be accessible at any time and place wherever there is internet access [5]. LMS platforms have encouraged a more independent learning style and provided learners with resources online instead of physical books [6].

B. LMS

LMS is a "comprehensive, integrated software that supports the development, delivery, assessment, and administration of courses in traditional face-to-face, blended, or online learning environments" [7]. Malaysian universities have been implementing blended learning through open-source and proprietary LMS. Staff and students seem to have taken up the use of LMS to a considerable extent. For instance, an EDUCAUSE core data service study in 2014 demonstrated that 99% of 151 institutions had an LMS, 85% of teaching staff used one, 83% of students used one, 74% of staff considered LMS a helpful tool for teaching, and 71% claimed it was useful for student learning.

At the most basic level, the features of an LMS include course resource management (sharing course materials: lecture notes, tutorials, reading materials, or grade lists), student involvement activities (e.g., group work, assessments, or quizzes), communication features (e.g., announcements, forums, or chats), and productivity features (e.g., using calendars or schedulers). A Malaysian study found that all 30 universities examined had an LMS in place. However, not all lecturers and students used them [8]. Many features of one university LMS were under-used as most students used LMS mainly for downloading course materials only [9]. Therefore, although LMS is available at many universities, lecturers and students are not fully utilizing its features and benefits.

Deep structure usage is the use of features in an Information System (IS) that supports the underlying structure of the task [10]. However, there is a lack of research on deep structure usage of LMS features based on the existing literature.

C. Research Questions

This study primarily investigates factors influencing satisfaction and deep structure usage of LMS features among

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lecturers in private universities at the post-acceptance stage.

Deep structure usage of LMS refers to the use of its features for a wide range of tasks, such as course resource management (sharing course materials: lecture notes, tutorials, reading materials, or grade lists), student involvement tasks (e.g., group work, assessments, or quizzes), communication tasks (e.g., announcements, forums, or chats), and productivity tasks (e.g., using calendars or schedulers). Several criteria can define satisfaction, including users' confirmed expectations, perceived ease-of-use, and perceived usefulness.

This research examines the relationships between the following variables: perceived usefulness and satisfaction, confirmation of expectation and perceived usefulness, confirmation of expectation and satisfaction, perceived usefulness and deep structure usage of LMS, and satisfaction and deep structure usage of LMS.

The following Research Questions will be addressed:

1) What are the factors influencing user satisfaction with LMS at the post-acceptance stage?
2) What factors influence the deep structure usage of LMS features at the post-acceptance stage?

II. Literature Review

A. Information Systems Acceptance, Continuance, and Use

Research on educational IS, including LMS over the past 15 years, has mainly concentrated on initial adoption and acceptance intention [11], [12], adoption and use [13], [14], perceptions or factors influencing use [15], effectiveness of tools [16], barriers to technology adoption [17], [18], determinants of continuance behavior intention [19], [20], end-user satisfaction [21], work outcomes [22], deep IS usage [23], extended use [24], post-adoption variations in usage and value [25], actual continuance usage [26], and determinants of continued IS usage intention [27].

Many of these studies used theoretical models to describe the determinants of intention to use or accept IS systems. The most widely used models were the Technology Acceptance Model (TAM) [28] and Venkatesh's Unified Theory of Acceptance and Use of Technology (UTAUT) [29].

B. Research Gaps

As discussed by [30], the continued use of LMS tools post-acceptance ensures the system's long-term viability. Asian countries have invested significantly in e-learning systems; therefore, maximum investment returns are achievable by continuously using the tools at total capacity [14].

Furthermore, current research focuses significantly on the intention to use and continue using technology instead of actual user behavior. The frequency of use and usage time were explored but with limited attention to feature usage details [31], [32]. Despite this, intention cannot be regarded as the sole predictor of behavior, particularly when an action becomes habitual [33]. Therefore, intention is not included in the conceptual model for this paper, following the model by [30].

Studies on LMS in Malaysian universities have mainly explored students' perspectives more than lecturers' perspectives, and there is also limited research conducted in private universities. Consequently, social influence affected students' decisions to continue using e-learning systems [34]. Thus, lecturers play a significant role in motivating students to use and continue using the tools [34], [35] since students often view faculty members as role models [36]. If the lecturers fully utilize the tools, students are encouraged to follow their example.

C. IS Implementation Stages

A study by [37] depicted organizational IS implementation in six stages: initiation, adoption, adaptation, acceptance, routinization, and infusion, as shown in Fig. 1.

Fig. 1. IS implementation model [37].

The initiation stage is when an organization explores potential technological solutions to improve organizational tasks or current practices. Subsequently, the organization invests in the technology during the adoption stage. The adaptation stage occurs "…when the application is developed, installed, and maintained" [38]. Once an organization adopts a system, staff will be encouraged to accept and use it, which describes the acceptance stage [38]. Then, the organization goes through the routinization stage, where the use of the system becomes a part of their regular activity. Finally, the infusion stage occurs when the system is fully utilized and maximizes the overall benefit toward organizational effectiveness.

Routinization and infusion stages are considered the post-acceptance stage of IS implementation [23]. Even though the IS implementation literature has widely acknowledged a post-acceptance or continuance stage, continuance is mainly viewed as an extension of acceptance [30]. It is worth noting that users' beliefs and judgments tend to change after initial use [30], which needs to be understood better. However, few studies have investigated the post-acceptance stage in the context of educational systems.

D. Expectation-Confirmation Model of Information Systems Continuance (ECM)

This study utilizes ECM of [30] shown in Fig. 2, as the basis to study lecturers' LMS usage behavior in the continuance stage. ECM is based on the widely used Expectation-Confirmation Theory (ECT) in the consumer behavior literature. ECT describes that consumers initially develop *expectations* (v1) of a product or service when intending to repurchase it. Once purchased and after a period

of use, they form *perceptions of its performance* (v2). Subsequently, the consumers will compare the perceptions of performance to their initial expectations of the product or service. The comparison culminates their *confirmation of expectation* (v3), and *satisfaction* (v4) for the product or service is decided as a result. Satisfaction influences consumers to repurchase, whereas dissatisfaction influences consumers to discontinue purchase. Thus, satisfaction with prior use is a crucial determinant of *repurchase intention* (v5).

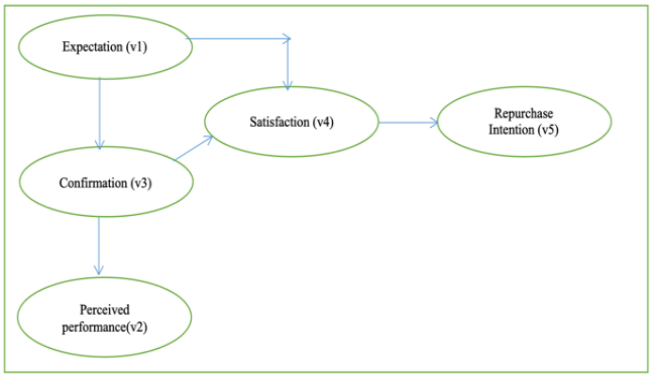

Fig. 2. Expectation-Confirmation theory [30].

IS users' continuance decisions are comparable to consumers' repurchase intentions [30]. This similarity stems from the fact that continuance and repurchase occur after the initial acceptance of a system, service, or product purchase. The user experience will decide whether to continue or discontinue using a system or, in the case of a product, to repurchase or not.

Despite these similarities, the ECM of IS continuance differs from ECT in three ways. First, ECM only focuses on post-acceptance variables. Second, it examines post-consumption expectations instead of pre-consumption expectations. Finally, ECM represents expectation as perceived usefulness, derived after acceptance and initial use in TAM [28]. Perceived usefulness consistently influences user intention at different stages of IS use [30].

Like ECT, ECM posits that IS continuance intention (v4) is primarily determined by satisfaction (v3). Meanwhile, satisfaction is influenced by the confirmation of expectation (v2) and user's Perceived Usefulness (v1) of the IS.

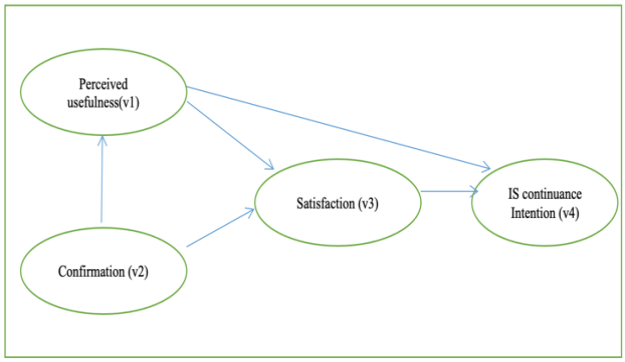

Fig. 3. Post-Acceptance model of is continuance [30].

Perceived usefulness is a construct adapted from TAM; thus, understanding the underlying differences between factors influencing user acceptance and continuance is necessary. Perceived usefulness was defined as "…the degree to which a person believes that using a particular system would enhance his or her job performance" [28]. In contrast, perceived ease-of-use was defined as "…the degree to which a person believes that using a particular system would be free of effort." Ultimately, TAM suggests that both variables influence IS acceptance behavior.

Perceived usefulness was more influential and consistent than perceived ease-of-use in determining user behavior [28]. This finding was also observed in [39], where perceived ease-of-use became less significant in later stages after users gained experience. There is a difference between acceptance by adopters and continued use by users. Adopters are a class of users who have no prior knowledge of the system when they decide to use it. Therefore, adopters focus more on technology characteristics, such as ease-of-use, result demonstrability, visibility, and trialability. In comparison, experienced users' decisions to continue using are more rational; they are based on task-centered attributes [39].

E. Proposed Framework

A critical analysis was conducted on a study investigating extended use behavior in the context of Enterprise Resource Planning systems (ERP) in a manufacturing company using a synthesized model of ECM and TAM. The study found perceived ease-of-use as having the most substantial influence of extended use, followed by perceived usefulness; meanwhile, satisfaction did not significantly influence extended usage [24]. It is assumed that perceived ease-of-use outweighed perceived usefulness as the extended features were more complex, and usage of these sophisticated features is highly influenced by the amount of effort necessary to cope with the complexity. Thus, perceived ease-of-use was a significant determinant in that context.

This finding contradicts a cross-sectional comparison study of pre-adoption and post-adoption beliefs, which argued that perceived usefulness is more critical than perceived ease-of-use for users with experience using a system as opposed to potential adopters of systems who value ease-of-use more [39]. Consistent with ECM, confirmation of expectation influenced satisfaction, perceived ease-of-use, and perceived usefulness. A limitation of the study was that the construct measurement for the extended use did not capture which class of feature or function was used; instead, it only measured the frequency of usage.

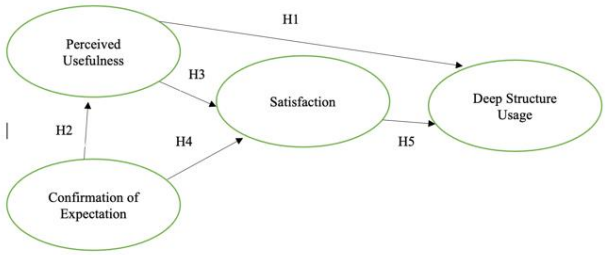

Fig. 4. Conceptual framework of the study.

A comparison of studies in the context of educational tools shows similar findings in that satisfaction and perceived usefulness influence intention and that perceived usefulness and confirmation influence satisfaction [33]. [20] found that

perceived usefulness, confirmation, and task-technology fit to influence students' continuance intention. Similar patterns in terms of determinants of intention and usage with minor contradictions have been found in previous studies influencing the choice of variables for this study. Given that ERP systems are very sophisticated compared to LMS, this study uses perceived usefulness instead of perceived ease-of-use. Besides this, the other variables for this study are confirmation of expectation and satisfaction, which are similar to the ECM and deep structure usage as an added variable.

Fig. 4 shows the theoretical framework based on the ECM of [30], as shown in Fig. 3. IS continuance intention was omitted, whereas deep structure usage was included as a dependent variable.

The definitions of the constructs are as follows:

Perceived usefulness: "The degree to which a person believes that using LMS would enhance his or her job performance" [28].

Confirmation of expectation: "Users' perception of the congruence between the expectation of LMS use and its actual performance" [30].

Satisfaction: "Users' effect with (feelings about) prior LMS use" [30].

Deep structure usage: "Use of a class of features in LMS that support the underlying structure of the task" [10].

The following hypotheses are derived based on the theoretical framework in Fig. 4.

H1: Users' perceived usefulness of LMS positively correlated with the deep structure usage of LMS features.

H2: Users' extent of confirmation of expectation positively correlated with their perceived usefulness of LMS use.

H3: Users' perceived usefulness of LMS positively correlated with their satisfaction with LMS use.

H4: Users' extent of confirmation of expectation positively correlated with their satisfaction with LMS use.

H5: Users' satisfaction with LMS use positively correlated with deep structure usage of LMS.

III. Materials and Methods

A. Web Survey Method

A survey is a frequently used method in information systems and educational research. Surveys collect quantitative data in the form of opinions, behavior, or characteristics of a population [40].

[41] stated that "Surveys are usually associated with the deductive research approach and tend to be used for exploratory and descriptive research to answer who, what, where, how much, and how many questions."

This study followed a deductive approach, and it is also descriptive, exploratory, and explanatory. The criteria for the choice of web survey research method was based on the research approach followed in this study, coupled with the research objectives and the nature of the research questions, which are mainly "what" questions. The main consideration for respondents in this study was lecturers from private universities in Klang Valley that have implemented LMS for more than 2 years and are in the post-acceptance stage at the institutional level. Since the respondents involved in this study were lecturers who use emails in their work and are familiar with online forms, this further justified the choice of web survey research method.

The survey research method has characteristics that are applicable and relevant to this study. First, surveys are an economical way to quickly collect large amounts of data. A web-based survey was employed to collect data from lecturers in different institutions with different teaching, consultation, and research schedules. Second, surveys allow problems and objectives to be clearly defined, culminating in structured and predefined questions. Before conducting the survey, the problem statement, research objectives, and research questions were clearly outlined, and questions that made up the survey were designed to be in line with them.

Third, surveys can be conducted using various instruments, such as questionnaires, structured observations, and structured interviews. In this study, questionnaires were chosen as the instrument for collecting data. Fourth, quantitative data gathered in surveys can be analyzed and interpreted using statistical tests. Quantitative data provided the necessary input for this study in terms of LMS features widely used by lecturers, alternative tools preferred by lecturers, and the main challenges lecturers face in using LMS, which provided the descriptive aspects of the study. The proposed theoretical framework explored the correlations between the independent variables confirmation and perceived usefulness with each of the dependent variables satisfaction and deep structure usage. The findings from the correlation analysis further explained what contributes to satisfaction and deep structure usage of LMS. Finally, the findings can be generalized if the survey sample represents the entire population. However, the findings are not generalizable due to limited sample, but they provide insight for further research.

B. Questionnaires

A questionnaire was defined as "a general term to include all methods of data collection, where each person is asked to respond to the same set of questions in a predetermined order" [41]. In this study, a web-based self-completed questionnaire was employed. A web-based questionnaire was defined as "a survey instrument for collecting data available on the computer" [40]. Google forms were used to design and create the web-based questionnaire. Then, an email invitation to participate in this study was sent out with a link to an internet-mediated self-administered questionnaire.

A study by [41] quoted [42], stating, "Internet- and intranet-mediated questionnaires, and in particular, those administered with email, offer greater control because most users read and respond to their mail at their personal computer." Additionally, a web-based questionnaire economically enables data collection from a large and geographically dispersed population and provides faster response rates [30]. Furthermore, self-administered questionnaires give the respondents the flexibility to respond at their convenience, provide anonymity, and remove researcher bias in influencing responses [43]. Web-based survey questionnaires allow flexibility in prompting different

sets of questions to respondents based on their answers to specific questions presented earlier [43].

However, there is a limit to the number of questions included in the questionnaire to avoid respondent fatigue; thus, reducing the breadth of data collected [44]. Web-based surveys are often linked with low response rates [45]. This low response rate can be caused by non-random sampling, technological problems, security issues, and internet junk and spam mail filters.

These limitations were considered. Focal points in the targeted institutions helped pass on the study email invitation to the participants to avoid bulk email messages being wrongly labeled as spam or junk mail. Additionally, after 2 weeks of initial invitation, reminders were sent to improve response rates.

C. Data Collection and Questionnaire

The final version of the web-based survey questionnaire consists of three sections. Section A contains 10 items on LMS usage and non-usage information and the challenges faced using an LMS (for non-users). Section B contains 18 items on factors affecting LMS usage, which only require a response by LMS users. Finally, Section C consists of five items to collect demographic information, such as gender, age, years of teaching experience, levels of study taught, and an optional question on the institution the respondent is currently working at.

Section A had two compulsory questions on whether LMS use was mandatory and if the respondent was currently using LMS for teaching and learning. The answers to these critical questions determined two sets of prompt questions. The LMS users were asked how long respondents had been using the LMS, usage frequency, LMS features usage details, tool preferences, and an open-ended question on suggestions for improving LMS. Meanwhile, the non-users were prompted to explain their utilization of LMS and their current teaching tools.

Section B of the questionnaire measures the research constructs: perceived usefulness, satisfaction, confirmation of expectation, and deep structure usage. All constructs were measured on a 5-point Likert scale. A few examples of measures used in the questionnaire in Section B are given as follows:

Using the LMS enables me to accomplish my tasks more quickly.

Using the LMS increases my productivity.

I find the LMS offered in my institution useful in my teaching tasks.

Using the "course resource" feature helps me manage my course materials better.

My experience using the LMS was better than what I expected.

The benefits of using LMS features and functions were better than what I expected.

How do you feel about your overall experience of LMS use: Very dissatisfied/very satisfied.

In a typical semester, I often use the course resource features to manage my course materials and students' grade list, among others.

In a typical semester, I often use features such as group work, online quizzes, and assessments to promote student involvement.

The questionnaire was finalized based on feedback from a pilot study on the initial draft questionnaire. The pilot study respondents consist of lecturers from four Malaysian private universities, similar to the target population of the actual survey [46]. The pilot study was conducted to ensure respondents could understand and answer the questions and ascertain that the responses could be recorded accurately. Feedback was obtained on the practicality of time required to complete the survey, instructions clarity, clearness of questions, objections in responding to any question, the questionnaire layout, and general comments for improvement.

The pilot study respondents were satisfied with the questionnaire design in terms of length of time to complete, clarity, and ease of answering. However, there were four minor suggestions for consideration. The first suggestion was to include a short description of LMS as an introduction to the questionnaire. Second, LMS features were recommended for Question 6 in Section A to be split individually instead of grouping them by category. The third suggestion was to change from a 7-point Likert scale to a 5-point scale to avoid respondent fatigue. Finally, the non-users of LMS were asked to be excluded from answering Section B as they could potentially influence responses. All four suggestions were implemented.

D. Sampling

Out of the 47 private universities in Malaysia, 33 are located in Selangor and Kuala Lumpur (or Klang Valley for short). The population for this study consists of lecturers from private universities in Klang Valley who had implemented LMS for more than 2 years and were in the post-acceptance stage at the institutional level. A preliminary investigation successfully identified private universities in Klang Valley that fit the sampling criteria.

However, information was not readily available for all 47 private universities. Despite that, four institutions fulfilled the sampling criteria: Universiti Tunku Abdul Rahman (UTAR) Bandar Sg. Long Campus, Sunway University, Taylors University, and Open University Malaysia (OUM). [47] stated that it is not feasible to collect data from an entire population, although ideally, this would be the aim.

In this study, the empirical data were collected from lecturers at the identified private universities. Non-probability voluntary sampling was used, which specifies there is little control over the choice of the sample and participants voluntarily participate in response to an invitation or appeal [48].

A total of 200 emails (50 for each identified institution) inviting voluntary participation from the lecturers were sent. Personalized cover letters were sent to potential respondents with email addresses publicly available on the institutions' websites to improve response rates. The email message included the project title, timeline, estimated length of time required to fill the survey, and the web link to the survey. The participants were given about one month to submit the questionnaire.

Ethical concerns were carefully addressed. The ethical concerns identified were the voluntary nature of participation and participants' rights. Participants' rights include the right to withdraw from the study at any time without explanation, request for any data supplied up to that point be withdrawn, and omit or refuse response to any question asked. The participants' anonymity was assured in compliance with the Data Protection Act and Freedom of Information Act. The participant consent form was also provided.

Despite sending reminders and leaving the survey open for more than two months, only a 27% response rate was obtained. For the post-acceptance deep structure usage of LMS data analysis, 51 out of the 54 responses met the criteria of being LMS users with more than one year of experience. The remaining three respondents were non-users of LMS and analyzed for reasons of non-usage. The sample consists of different age groups, gender, teaching levels, teaching experience, and experience using LMS.

IV. Analysis and Results

Statistical Package for Social Science (SPSS) Version 23 was used to code data, validate the measurement scales, and summarize participants' demographic information. Descriptive and inferential analysis techniques were conducted to analyze the data and test the hypotheses.

Cronbach's alpha was used to calculate the internal consistency of scale items. The cut-off point for acceptable internal consistency was an alpha coefficient of 0.7 and above [46]. The result of this analysis is presented and interpreted in the next section.

Descriptive statistics, such as frequencies and percentages, were used to organize and present each demographic trait of the participants. The demographic data include gender, age, teaching experience, whether the participant was a user or non-user of LMS, years of experience with LMS, and LMS usage setting for the institution, whether mandatory or voluntary. The demographic breakdown is presented and discussed in the next section.

To address research Questions 1 and 2, two separate multiple regression analyses and ANOVA tests were completed for the dependent variables: satisfaction and deep structure usage. The adjusted R-Square and F-ratio values were evaluated for statistical significance.

Data analysis for the formulated hypotheses involved generating descriptive statistics means and standard deviations. The formulated hypotheses were tested using Pearson's product-moment correlation coefficient.

As a general guideline, a correlation coefficient (r) between 0.5 and 1 indicates a strong relationship between variables [46]. The correlations were measured at a significance level of 0.01 (two-tailed).

This measurement portrays a high significance level, indicating that only 1% of the results were based on chance. The relationships were further tested by computing the variance shared by the two variables in each relationship.

Table I shows that there were 26% more females than males in this study, and 87% of them were over 40 years old. Additionally, 93% had more than 5 years of teaching experience. Almost 95% were currently using the LMS, whereas 90% used it for more than 3 years.

TABLE I: Lecturers' Demographic Information

		Frequency	Percentage
Gender	Male	20	37.0
	Female	34	63.0
Age	Less 30	0	
	30–39	7	13.0
	40–49	37	68.5
	50-59	8	14.8
	> 59	2	3.7
Teaching experience	< 1 year	0	
	1–5 years	4	7.4
	> 5 years	50	92.6
Currently Using LMS	Yes	51	94.4
	No	3	5.6
Years Using LMS (Current Users)	Less than 1 year	0	
	Between 1 and 3 years	5	9.8
	More than 3 years	46	90.2

A. Scale Validation

Guaranteeing that the data collection instruments used in a study are valid and reliable is vital. Validity ensures that the instrument measures what it intends to measure, whereas reliability ensures data collection consistency [41]. Cronbach's alpha coefficient of 0.7 and above was the cut-off point for internal consistency. The coefficient of each construct was calculated using SPSS. The findings are summarized in Table II.

As presented in Table II, each construct possessed internal consistency with alpha values above 0.7. The table item-total statistics for each construct were generated. The column "Cronbach's alpha if item deleted" was verified to see if the alpha values were improved with any item deletion. Furthermore, the column "Corrected item-total correlation" was examined to be of at least 0.3 as any value below, indicating that the item is measuring something different from the scale and needs to be removed [46]. No item was removed from this analysis.

TABLE II: Cronbach's Alpha (A) Coefficient for Each Construct in the Questionnaire

Research Construct	No. of Items	Cronbach's Alpha
Perceived Usefulness	7	0.875
Confirmation of Exp	3	0.844
Satisfaction	4	0.960
Deep Structure Usage	4	0.729

B. Results and Analysis for Research Questions

The proposed theoretical framework investigates the factors influencing lecturers' satisfaction and deep structure usage of LMS by examining the relationships between:

1) Perceived usefulness and satisfaction
2) Confirmation of expectation and perceived usefulness
3) Confirmation of expectation and satisfaction
4) Perceived usefulness and deep structure usage of LMS
5) Satisfaction and deep structure usage.

Two separate multiple regression analyses were conducted to analyze the relationships between:

1) Perceived usefulness and satisfaction with deep structure

usage, as presented in Table III. The adjusted R-square value of 0.729 indicates that perceived usefulness and satisfaction explain the 72.9% variance in deep structure usage. The F-ratio value of 68.266 at the 0.000 level in the ANOVA Table IV indicates that the model is highly significant. The variance in deep structure usage is explained through perceived usefulness and satisfaction.

2) Confirmation of expectation and perceived usefulness with satisfaction, as presented in Table V. The adjusted R-square value of 0.605 shows that confirmation of expectation and perceived usefulness explain the 60.5% variance in satisfaction. The F-ratio value of 39.302 at the 0.000 level in the ANOVA Table VI indicates that the model is highly significant. The variance in satisfaction is explained by confirmation of expectation and perceived usefulness.

TABLE III: MULTIPLE REGRESSION MODEL SUMMARY (PU, S, DSU)

Model	R	R-Square	Adjusted R-Square	Std. Error of the Estimate
1	.860*	.740	.729	.383

*Predictors: (Constant), PU, S

TABLE IV: ANOVA* (PU, S, DSU)

Model	Sum of Squares	Df	Mean Square	F	Sig.
39 **Regression**	20.069	2	10.035	68.266	.000**
Residual	7.056	48	.147		
Total	27.125	50			

*Dependent Variable: DSU **Predictors: (Constant), PU, S

TABLE V: MULTIPLE REGRESSION MODEL SUMMARY (CE, PU, S)

Model	R	R-Square	Adjusted R-Square	Std. Error of the Estimate
1	.788*	.621	.605	.448

*Predictors: (Constant), CE, PU

TABLE VI: ANOVA* (CE, PU, S)

Model	Sum of Squares	Df	Mean Square	F	Sig.
39 **Regression**	15.742	2	7.871	39.302	.000**
Residual	9.613	48	.200		
Total	25.355	50			

*Dependent Variable: S **Predictors: (Constant), CE, PU

The results were interpreted using the correlation coefficient guideline in Table VII [46]. The variance shared by the two variables was also computed by squaring the coefficient of determination, r^2.

TABLE VII: CORRELATION COEFFICIENT GUIDELINE TABLE: [47]

Strength of Relationship	Coefficient (r)
Small	0.10 - 0.29
Medium	0.30 - 0.49
Large	0.50 - 1.0

H1: Users' perceived usefulness of LMS is positively correlated with the deep structure usage of LMS features.

TABLE VIII: DESCRIPTIVE STATISTICS FOR PERCEIVED USEFULNESS AND DEEP STRUCTURE USAGE

	Mean	Std. Deviation	N
PU	3.80	..683	51
DSU	3.50	.737	51

TABLE IX: CORRELATIONS FOR PERCEIVED USEFULNESS AND DEEP STRUCTURE USAGE

	PU	DSU
PU Pearson Correlation	1	.859**
Sig. (2-tailed)		.000
N	51	51
DSU Pearson Correlation	.859**	1
Sig. (2-tailed)	.000	
N	51	51

**. Correlation is significant at the 0.01 level (2-tailed).

Table VIII shows the descriptive statistics for perceived usefulness and deep structure usage. There was a strong positive correlation between perceived usefulness and deep structure usage with a coefficient value of 0.859 as shown in Table IX. Perceived usefulness explained the 74% variance in respondents' scores of deep structure usage.

H2: Users' extent of confirmation of expectation is positively correlated with their perceived usefulness of LMS use.

TABLE X: DESCRIPTIVE STATISTICS FOR CONFIRMATION OF EXPECTATION AND PERCEIVED USEFULNESS

	Mean	Std. Deviation	N
CE	3.81	.633	51
PU	3.80	.683	51

TABLE XI: CORRELATIONS FOR CONFIRMATION OF EXPECTATION AND PERCEIVED USEFULNESS

	PU	CE
PU Pearson Correlation	1	.750**
Sig. (2-tailed)		.000
N	51	51
CE Pearson Correlation	.750**	1
Sig. (2-tailed)	.000	
N	51	51

**. Correlation is significant at the 0.01 level (2-tailed).

Table XI shows the descriptive statistics for confirmation of expectation and perceived usefulness. The analysis showed a strong positive correlation between perceived usefulness and confirmation of expectation with a coefficient value of 0.75 as shown in Table XI. Moreover, the confirmation of expectation explained the 56% variance in

respondents' scores of perceived usefulness.

H3: Users' perceived usefulness of LMS is positively correlated with their satisfaction with LMS use.

TABLE XII: DESCRIPTIVE STATISTICS FOR PERCEIVED USEFULNESS AND SATISFACTION

	Mean	Std. Deviation	N
S	3.98	.712	51
PU	3.80	.683	51

TABLE XIII: CORRELATIONS FOR PERCEIVED USEFULNESS AND SATISFACTION

	PU	S
PU Pearson Correlation	1	.732**
Sig. (2-tailed)		.000
N	51	51
S Pearson Correlation	.732**	1
Sig. (2-tailed)	.000	
N	51	51

**. Correlation is significant at the 0.01 level (2-tailed).

Table XII shows the descriptive statistics for perceived usefulness and satisfaction. Additionally, perceived usefulness and satisfaction were positively correlated with a coefficient value of 0.732 as shown in Table XIII. Perceived usefulness described almost 54% variance in respondents' scores of satisfaction.

H4: Users' extent of confirmation of expectation is positively associated with their Satisfaction with LMS use.

TABLE XIV: DESCRIPTIVE STATISTICS FOR CONFIRMATION OF EXPECTATION AND SATISFACTION

	Mean	Std. Deviation	N
CE	3.81	.633	51
S	3.98	.712	51

Table XIV above shows the descriptive statistics for confirmation of expectation and satisfaction. The relationship between confirmation of expectation and satisfaction has a coefficient value of 0.742 as shown in Table XV above, demonstrating a strong positive correlation. It was also found that satisfaction explained the 55% variance in respondents' scores.

TABLE XV: CORRELATIONS FOR CONFIRMATION OF EXPECTATION AND SATISFACTION

	S	CE
S Pearson Correlation	1	.742**
Sig. (2-tailed)		.000
N	51	51
CE Pearson Correlation	.742**	1
Sig. (2-tailed)	.000	
N	51	51

**. Correlation is significant at the 0.01 level (2-tailed).

H5: Users' satisfaction with LMS use is positively correlated with deep structure usage of LMS.

TABLE XVI: DESCRIPTIVE STATISTICS FOR SATISFACTION AND DEEP STRUCTURE USAGE

	Mean	Std. Deviation	N
S	3.98	.712	51
DSU	3.50	.737	51

TABLE XVII: CORRELATIONS FOR SATISFACTION AND DEEP STRUCTURE USAGE

	S	DSU
S Pearson Correlation	1	.655*
Sig. (2-tailed)		.000
N	51	51
DSU Pearson Correlation	.655**	1
Sig. (2-tailed)	.000	
N	51	51

**. Correlation is significant at the 0.01 level (2-tailed).

TABLE XVIII: CORRELATIONS BETWEEN ALL VARIABLES

	CE	PU	S	DSU
CE Pearson Correlation	1	.750**	.742**	.672**
Sig. (2-tailed)		.000	.000	.000
N	51	51	51	51
PU Pearson Correlation	.750**	1	.732**	.859**
Sig. (2-tailed)	.000		.000	.000
N	51	51	51	51
S Pearson Correlation	.742**	.732**	1	.655**
Sig. (2-tailed)	.000	.000		.000
N	51	51	51	51
DSU Pearson Correlation	.672**	.859**	.655**	1
Sig. (2-tailed)	.000	.000	.000	
N	51	51	51	51

**. Correlation is significant at the 0.01 level (2-tailed).

Table XVI shows the descriptive statistics for satisfaction and deep structure usage. Furthermore, the relationship between satisfaction and deep structure usage was positively correlated with a coefficient value of 0.655 as shown in Table XVII. There was a 43% variance in respondents' scores of deep structure usage, explained by satisfaction.

In summary, all five hypotheses were adequately supported. In response to Research Question 1, Table XVIII shows that satisfaction correlated with confirmation of expectation, perceived usefulness, and deep structure usage; however, it is most positively correlated with confirmation of expectation.

V. DISCUSSION AND CONCLUSION

This section discusses factors influencing post-acceptance satisfaction and deep structure usage of LMS, theoretical and practical implications of the research, limitations, and future recommendations. Prior research on LMS adoption has mainly focused on the determinants of users' continuance intention instead of the actual usage. Thus, this research set out to address the gaps in the literature on post-acceptance satisfaction and deep structure usage of LMS. The two research questions: "What are the factors influencing user satisfaction with LMS at the post-acceptance stage?" and "What are the factors influencing the deep structure usage of LMS features at the post-acceptance stage?" were aptly examined. Confirmation of expectation and perceived usefulness were principally examined as determinants of satisfaction. Both variables were positively correlated with satisfaction. Furthermore, confirmation of expectation was the strongest predictor of satisfaction. The findings reflect those reported in [26], [30], [31], [33].

This study provides new insights by exploring the

combined effect of satisfaction, confirmation of expectation, and perceived usefulness on deep structure usage of LMS. The combined effect of these variables had a positive impact on deep structure usage of LMS, consistent with [24] in the context of ERP systems.

A. Theoretical Implications

This study further enhances the IS continuance literature by investigating user behavior instead of usage intention on e-learning systems continuance.

Additionally, the ECM of IS continuance was modified by replacing intention with the deep structure usage as a dependent variable. Previous research with usage or usage intention as the dependent variables focused on usage duration and frequency. However, deep structure usage is a more holistic and detailed measure of system usage, incorporating the system, task, and user [10].

B. Practical Implications

This study targeted lecturers instead of students. LMS use involves a change of habit and routine when incorporating the systems into their work. Lecturers are the influential drivers of LMS system usage. If lecturers fully utilize the systems, students will tend to follow suit, particularly if lecturers make it a requirement. Furthermore, there is a strong relationship between lecturers' roles and system design to students' attitudes in using a system [49]. The findings will enable policymakers to estimate lecturers' willingness and readiness to fully utilize LMS and measure the intended results in the post-acceptance stage of LMS.

Confirmation of expectation was the most significant predictor of LMS satisfaction. This finding could encourage management to perform routine feedback surveys among the tools used to verify if expectations are met. When the feedback is addressed, the more satisfied users will be and creates a better working environment.

Additionally, lecturers' perceived usefulness of LMS features in supporting their teaching task played a significant role in their deep structure usage. Designers could benefit from these inputs to ensure that the insignificant features are removed and the best features are incorporated into new future tools or if an institution decides to replace the current LMS. The latter is highly probable as one in five institutions planned to replace their existing LMS with a new one [50].

Trial runs or pilot studies could be conducted to test the perceived usefulness of components or features before implementing a new system. The LMS can be improved to meet user preferences and needs based on the feedback obtained from the trial runs or pilot studies [51].

C. Limitations and Recommendations

The main limitation of this study is that the sample is limited to lecturers from private higher learning institutions in the Klang Valley. Therefore, generalizing the results of this study to the public and private higher learning institutions in Malaysia may not be appropriate as the findings may not represent the wider population. Moreover, all data were collected cross-sectionally at one point in time, and thus, the data were a snapshot of perceptions limited by time and place.

Future research can extend the model to study determinants of satisfaction and confirmation of expectation with specific LMS features. Based on the suggestions collected for LMS improvement, satisfaction and confirmation of expectation can be classified into the technical, design, capability, and experiential aspects. These recommendations for future research can help deepen understanding of factors influencing satisfaction and confirmation of expectation, directly influencing deep structure usage.

Conflict of Interest

The author declares no conflict of interest.

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