

RESEARCH ARTICLE



OPEN ACCESS

Received: 23-03-2023

Accepted: 16-07-2023

Published: 01-09-2023

Citation: Tanye HA, Asampana I, Akwetey Matey H, Akanferi AA, Koi-Akrofi G, Nurudeen M (2023) The Diffusion of LMS among Distance Learning Students in Ghana using the Diffusion of Innovation Theory. Indian Journal of Science and Technology 16(33): 2622-2630. <https://doi.org/10.17485/IJST/v16i33.683>

* **Corresponding author.**

hannah.tanye@upsamail.edu.gh

Funding: None

Competing Interests: None

Copyright: © 2023 Tanye et al. This is an open access article distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Published By Indian Society for Education and Environment ([iSee](https://www.indjst.org/))

ISSN

Print: 0974-6846

Electronic: 0974-5645

The Diffusion of LMS among Distance Learning Students in Ghana using the Diffusion of Innovation Theory

Hannah Ayaba Tanye^{1*}, Isaac Asampana¹, Henry Akwetey Matey¹, Albert Akanlisikum Akanferi¹, Godfred Koi-Akrofi¹, Mohammed Nurudeen¹

¹ University of Professional Studies, Accra, Ghana

Abstract

Objective: To research the elements affecting the use of LMS among Distance Learning Students at Public Universities in Ghana. The study contributes to our understanding of the many dimensions of the adoption of LMS, including their acceptability, use, and eventual integration into the user's daily life and how that influences their behaviour. **Methods:** This study only uses quantitative methods. This strategy was chosen because it involves an empirical analysis of the social phenomena surrounding LMS use by distance learning students in Ghana. To acquire the data required for the study, it uses quantitative data-gathering techniques like surveys. The study involved a survey of the variables affecting Ghanaian public university adoption of LMS in distance education, mentioning the sample size, period of coverage, demography, parameters considered, and how the analysis was made. **Findings:** Our findings show that the innovation characteristics all have a positive impact on the diffusion of innovations. Relative advantage had a positive impact ($t = 2.946$, $p\text{-value} = 0.003$). Compatibility also had a positive impact ($t = 4.23$, $p\text{-value} = 0.000$). Complexity, Trialability, and Observability also had a positive impact on the diffusion of innovations, as ($t = 6.144$, $p\text{-value} = 0.000$), ($t = 3.58$, $p\text{-value} = 0.000$), and ($t = 3.573$, $p\text{-value} = 0.000$), respectively. **Novelty:** The results showed that elements such as relative advantage, complexity, observability, trialability, and compatibility have a stronger impact on students' intentions to utilise the LMS. This implies that our findings have the potential to improve students' university academic achievement, and students may also consider the LMS advantageous if it can accommodate their learning needs. Hence, appropriate policies and strategies should be put in place to ensure that students find the LMS less complex, well-suited to their learning needs, and advantageous.

Keywords: Ghana; eLearning; Distance Learning; Adoption; University; Benefits

1 Introduction

In recent years, most universities have incorporated e-learning to augment their traditional face-to-face teaching methods. This teaching concept has allowed for greater flexibility, the removal of geographical barriers, and the enhancement of the effectiveness of individual and collaborative learning. Most universities in Ghana have adopted learning management systems (LMS) such as Moodle, Canvas, and Blackboard to aid the e-learning teaching process. According to previous studies (Jagadeesan and Subbiah in 2020; Yakubu et al. in 2020) cited in ⁽¹⁾, LMSs are web-based applications that are used to manage courses. They can provide the ability to track students' progress and make course resources more accessible. Students can access course resources as many times as they need using any internet-ready device from anywhere.

The implementation of LMS in educational institutions has revolutionised the teaching and learning process ⁽²⁾. LMS is used for designing, delivering, monitoring, and reporting educational courses and outcomes. It can be utilised to support both conventional face-to-face training and environments for blended/hybrid and online learning ⁽³⁾. LMS software is used in schools to organize, carry out, facilitate, evaluate, and keep track of student learning ⁽⁴⁾. All of these activities take place behind a virtual wall that offers some level of privacy, security, and authentication. Several research studies have come out with factors affecting the adoption of LMS. Most of them considered the initial implementation stages in most of the institutions.

Personality traits have been described in the context of e-learning as potential enablers of information technology acceptance and use as well as a way to predict these agents' behaviour in this process, according to ⁽¹⁾. ⁽¹⁾ also cited two previous studies to affirm that there has been little research on this personality trait in the literature. Although diffusion of innovation, specifically Learning Management Systems (LMS), has gained relevant attention in higher educational institutions, a few studies have been done to include personality traits in acceptance of technology ⁽¹⁾.

To fill gaps in the literature, the research will employ innovation diffusion theory to determine the effects of personality traits on LMS adoption.

Therefore, the research is carried out at the University of Professional Studies in Accra, Ghana, where the LMS has been in use for some time and students are quite familiar with it and have gained some benefits from it. The theory underpinning this research is the Innovation Diffusion Theory proposed by Roger in 1962. The available literature shows there has been quite a bit of research done using the Innovation Diffusion theory. Some research has found that observability and compatibility have a positive impact on the use of online systems ^(1,2), while complexity has a negative impact.

The University of Professional Studies, Accra (UPSA) was established in 1965 ⁽⁵⁾. To provide and promote higher professional education and training, the UPSA has decided to increase access to qualified candidates by using the open distance learning (ODL) approach, which gets around limitations imposed by time, place, and distance. This approach serves as a substitute for and complement to the traditional teaching and learning approach. With the UPSA ODL concept, prospective students have the option to enrol in the University's programmes using a blended learning strategy. A flexible programme and course structure are made available to prospective ODL students who meet the minimum entry requirements through a variety of teaching and learning techniques and high-quality course materials. This allows students to gain the knowledge and skills necessary for career opportunities and self-development. The CODL implemented a learning management system (LMS) that can support both completely online and blended learning approaches ⁽⁵⁾. The LMS is used for the Implementation of study manuals and delivery of various courseware, Interactions with students, Assessments (assignments and interim assessments), Electronic tutoring (E-tutoring), and course evaluation (lecturer/Student evaluation).

Notwithstanding measures put in place to enable the teachers to use the LMS effectively, there is still instructor resistance to the use of the LMS ⁽⁶⁾. This makes innovation diffusion among the instructor group very difficult. Students, on the other hand, are eager to use the innovation. The pedagogies underpinning these innovations are student-centred ⁽⁵⁾. The existing literature confirms that HEI does not have the full benefits of LMS, and thus there is a need for more research in that area ⁽⁶⁾.

With so much potential that LMS can revolutionize teaching and learning, HEI has not yet realized its full potential. Therefore, various governments are putting measures in place to ensure that Institutions get the most out of it. The Centre for National Distance Learning and Open Schooling (CENDLOS) was established by the Ministry of Education as one of its agencies. CENDLOS had a mandate to "reinforce Open and Distance Learning (ODL) at the post-secondary education level and make it a reality at the pre-tertiary stage" CENDLOS, as its mandate demands, has created content on many subjects run in the junior high schools and the senior high schools that is distributed to these schools. Efforts have been made towards using simulation in laboratory classes for science education in Ghana.

However, at the tertiary level, much has not been done. Most tertiary institutions are finding it challenging to create content. Their efforts to implement e-learning have failed in almost half of the projects ⁽⁷⁾. Various Higher educational institutions have their own policies and strategies for the delivery of eLearning as a measure to complement the face-to-face mode of teaching. They have created Distance Learning centres (DL) and made use of e-learning delivery strategies. As a result, the National Information Technology Agency (NITA) has endorsed new ways in which universities can use eLearning as a delivery mode

for Distance Learning centres. The Ghana government seeks to empower HEI to take advantage of technological advancement and glean the full potential of the LMS implemented in their various institutions.

The research conducted by⁽⁸⁾ looked at the use of the LMS Moodle in certain countries. The research failed to look at how the use of the LMS Moodle has diffused over time. Most researchers failed to look at innovation diffusion over time. For instance,⁽⁹⁾ argues that experience is very important in LMS usage. This research is conducted with a sample that has experienced the LMS Moodle for some time. In the literature, most research concentrates on the LMS implementation and not on characteristics that will enhance its diffusion in the HEI⁽¹⁰⁾. The objective of this study is to research the elements affecting the diffusion of LMS among Distance Learning Students at the University of Professional Studies in Accra, Ghana. The study contributes to our understanding of the many dimensions of the adoption of LMS, including their acceptability, use, and eventual integration into the user's daily life and how that influences their behaviour. The research questions are:

- a) What factors will affect users' intention to adopt and diffuse a learning management system?
- b) What factors will affect users' intentions towards choosing a learning management system?

2 Methodology

For the evaluation of the questionnaire's content, two experts from the University of Professional Studies in Accra, Ghana, were consulted. The study was conducted on undergraduate students who used the LMS at UPSA in terms of population and sample size. Students graded the items on a 5-point Likert scale in the Diffusion Theory (IDT) questionnaire. The primary technique for data analysis was structural equation modeling (SmartPLS Software). The PLS procedure consisted of two key steps: analyzing the structural model and evaluating the construct validity, convergent validity, and discriminant validity of the measurements.

2.1 Research Model and Hypotheses

The study is underpinned by the Diffusion of Innovation Theory. Diffusion means the spreading of an idea or particles from a more dense location to a less dense location. Different theories try to explain the process of Diffusion. The two-step hypothesis is explained by Lazarsfeld, Berelson, and Gaudet⁽¹¹⁾. In this theory, they stated that "information from the media moves in two distinct stages." Another theory of Diffusion is the trickledown effect⁽¹²⁾, the Crossing of a Chasm by Geoffrey Moore, and the Technology Driven Models. The most widely accepted diffusion theory is the Diffusion of Innovations theory by Rogers. Diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system⁽¹³⁾. The theory states that Relative Advantage, Compatibility, Complexity, Trialability, and observability influence LMS adoption and therefore its diffusion as shown in Figure 1 below.

2.2 The linkages between Diffusion of Innovations theory and Variables

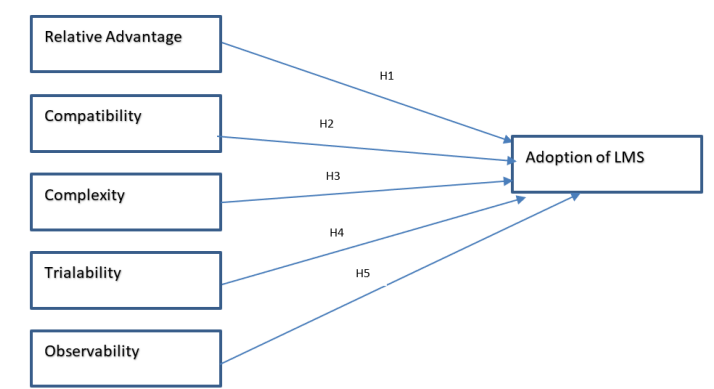


Fig 1. Conceptual Model

A relative advantage is the extent to which people believe the new, innovative solution is superior to the old, traditional one. This phrase refers to the extent to which students believe that using an e-learning system can improve their academic achievement in the current study⁽¹⁴⁾. The finding that intention to use the LMS is significantly influenced by perceived relative advantages has been reported by previous researchers⁽¹⁵⁾. This implies that students are more likely to have a stronger intention

to use an LMS if they perceive it to have a high relative advantage over alternatives. Based on the above reasons, the researchers hypothesized that

Hypothesis 1: Relative Advantage positively influences a student's intention to use LMS.

Perceived compatibility is the degree to which learners perceive an innovation to be compatible with their standards, prior experiences, and the preferences of potential adopters⁽¹⁴⁾. This phrase is used in this study to describe how the learners see the advantages of using the LMS. Perceived compatibility has frequently been employed in previous information system adoption studies as a behavioral intention to use indication for students⁽¹⁵⁾. According to this study, students can be persuaded to use an LMS because it could improve their online learning opportunities. Therefore, we hypothesize that:

Hypothesis 2: Compatibility positively influences a student's intention to use LMS.

Complexity is defined as the degree to which end users find it difficult to comprehend innovations and their simplicity of use. Based on this description, the phrases in the current study are used to describe how much difficulty a learner perceives as having an impact on his or her ability to learn. According to this survey, university students will probably view an LMS as an easy-to-use and practical solution for their learning requirements. Therefore, their decision to embrace LMS will be influenced by ease of use. Previous studies have shown that end users are less likely to use an LMS if they believe it to be complicated⁽¹⁵⁾. We hypothesize that:

Hypothesis 3: Complexity negatively influences a student's intention to use LMS.

Trialability is the degree to which people believe they must first try out an innovation before deciding whether or not to accept it. People who are considering adopting the trailable innovation tend to perceive it as having less uncertainty, and they also tend to gain from the experience. In the context of the current study, this idea refers to how a student perceives the impact of using an e-learning system on their ability to learn. According to this study, students are more likely to opt to adopt a technology if they see their peers using and showing interest in the LMS. Previous studies have shown that end users are more likely to use an LMS if they know it works⁽¹⁵⁾. As a result, we conclude that:

Hypothesis 4: Trialability positively influences a student's intention to use LMS.

Observability: According to the definition, observability refers to the degree to which "the outcome of the innovation is noticeable by others." It is thought that an adopter's friends and neighbours routinely ask him or her for input. Visibility is thought to encourage peer debate on novel concepts. Previous studies show that observability positively influences intention⁽¹⁵⁾. According to this study, students are more likely to decide to adopt a technology if they see their peers using it and showing interest in it. As a result, we surmise that:

Hypothesis 5: Observability positively influences a student's intention to use LMS.

2.3 Research Design and Method

We created and distributed an open-ended survey using Google Forms. Subjects were students of the University of Professional Studies, Accra, who were well-versed in the institution's learning management system (LMS). The proposed model was tested using data from 486 respondents. The valid respondents were 59.5% male and 40.5% female. Five latent independent factors in this study all point to one latent dependent variable. According to the 10-times rule, a minimum sample size of 50 should be used for PLS-SEM. For either (a) the number of indicators in the largest latent element block or (b) the greatest number of incoming causal arrows for each latent variable in the model, there should be at least 10 examples per measured variable, according to Hair et al. (2016), cited by⁽¹⁶⁾. The sample of the population was chosen using a simple random sampling method. This method was chosen for this study because it gives every member of the population an exact equal chance of getting chosen.

2.4 Data Collection

Four hundred and eighty-six valid responses were submitted to the online survey. According to the demographic information, there were more men (59.5%) than women (40.5%) among the respondents, who were mainly in their twenties. The respondents from 15-19 years were 10.7%, 20-29 years were 52.7%, 30-39 years 34.2%, and 40-49 years were 2.7%. Respondents' educational level were as follows, level 100 were 8%, level 200 were 43.8%, level 300 were 19.8% and Level 400 were 28.4%.

The instrument of measurement of the study adopts the instrument of measurement from^(17,18). The dependent variables are Observability, Trialability, Complexity, Compatibility, and Relative Advantage.

The questionnaire was divided into two sections and had a total of 26 questions and a Likert scale of four responses: strongly agree, agree, disagree, and strongly disagree. The first section was demographic data, which had four questions. Section two comprises relative advantage compatibility, complexity, trialability, observability, and security. Perceived relative advantage had 4 questions; compatibility had 4 questions; complexity had 4 questions; trialability had 4 questions; observability had 3 questions; and the behavioral intention had 4 questions.

Table 1. Summary of the Characteristics of Respondents

Attribute	Category	Frequency	Percentage (%)
Gender	Male	289	59.5
	Female	197	40.5
Age (in years)	15-19	52	10.7
	20-29	255	52.7
	30-39	166	34.2
	40-49	13	2.7
Educational Level	100	39	8
	200	213	43.8
	300	96	19.8
	400	138	28.4

2.5 Data Analysis

SmartPLS software was used to analyze the data. With the measurement model, Construct Reliability and validity, Discriminant validity using Fornell–Larcker Criterion, and Heterotrait-monotrait ratio (HTMT) were measured. The Structural Model, Path coefficients and their significance, and the results of R^2 .

3 Results and Discussion

3.1 Measurement Model

Reliability is defined by the web survey as the consistency of research results. That is the probability of producing the same results after repeated measurements. To ensure reliability in this research, the instruments were tested and retested. The scale of measurements of the data collection instrument was given to a sample of respondents to test their suitability. To ensure good reliability for the study, the test-retest was done in a short period of time.

This study includes reflecting metrics in its analysis of the measuring methodology. We started by examining the indicator loadings. When the loadings are larger than 0.50, the construct is responsible for more than half of the variation in the indicator⁽¹⁹⁾. The constructions' internal consistency and dependability were examined. For the composite reliability criteria, greater numbers represent better degrees of dependability. "Acceptable to good" reliability ratings range from 0.70 to 0.95⁽²⁰⁾. Cronbach's alpha, which assumes the same criterion, is used to quantify internal consistency and dependability.⁽²¹⁾ consider reliability ratings of 0.70–.95 reasonable. Convergent validity, which explains how a construct converges with the variance of the items, is also calculated. Convergent validity is measured using the items' average variance extracted (AVE) related to a particular construct. To be acceptable, the AVE must be 0.500 or higher⁽²²⁾ and it must account for (more than) 50% of the variation in its components on average. According to Table 2, all constructs had Cronbach alpha and composite reliability values higher than the permitted limit of 0.7.

Discriminant validity⁽²³⁾ is the final level that reveals how empirically distinct a notion is from others. The heterotrait-monotrait ratio of correlations is used to test discriminant validity in PLS-SEM. The heterotrait-monotrait (HTMT) ratio criterion, which surpasses the Fornell–Larcker criterion and cross-loading evaluations in PLS-SEM, is a novel condition for measuring discriminant validity⁽²⁰⁾. Tables 2 and 3 show the discriminant validity and HTMT measurement of the model's outcomes; all computations were reported to match the examination's standards.

3.1.1 Construct Reliability and Validity

Table 2. Construct Reliability and validity

Items	Constructs	Loadings	CA	CR	AVE
BI1	I want all courses to be offered via the LMS	0.813	0.916	0.941	0.799
BI2	I will use the LMS if it is available	0.911			
BI3	I will accept using LMS in the future	0.924			
BI4	It is easy using LMS for teaching and learning	0.922			
REA1	LMS enables me to accomplish tasks more quickly.	0.773	0.848	0.898	0.688

Continued on next page

Table 2 continued

REA2	LMS improves the quality of learning I do	0.900			
REA3	LMS makes it easier to do my assignment	0.800			
REA4	The disadvantages of LMS far outweighs the advantages.	0.839			
COMP1	LMS is compatible with all aspects of my study life.	0.873	0.902	0.933	0.779
COMP2	LMS is completely compatible with my current situation.	0.695			
COMP3	I think that LMS fits well with the way I like to study.	0.968			
COMP4	LMS fits into my study style.	0.967			
COMPX1	I believe that LMS is cumbersome to use.	0.866	0.928	0.949	0.822
COMPX2	It is easier for me to remember how to perform assignments using LMS.	0.928			
COMPX3	LMS requires a lot of mental effort.	0.912			
COMPX4	LMS is often frustrating	0.919			
TRIA1	I have had a great deal of opportunity to try various LMS system applications.	0.871	0.925	0.946	0.815
TRIA2	I know where I can go to satisfactorily try out various LMS Systems	0.915			
TRIA3	LMS systems were available to adequately test-run various applications.	0.911			
TRIA4	Before deciding whether to use any LMS applications, I was able to properly try them out	0.914			
OBSER1	I have seen what others do studying with LMS Systems.	0.891	0.805	0.883	0.717
OBSER2	In my Institution, one can perceive students' access to LMS Systems	0.711			
OBSER3	LMS tools and systems are not very visible in my Institution.	0.923			

3.1.2 Discriminant validity using Fornell–Larcker Criterion

Table 3. Discriminant validity using Fornell–Larcker Criterion

	Behavioral Intention to Adoption of LMS	Compatibility	Complexity	Observability	Relative Advantage	Trialability
Behavioral Intention to Adoption of LMS	0.894					
Compatibility	0.222	0.883				
Complexity	0.631	0.05	0.906			
Observability	0.193	0.969	0.073	0.847		
Relative Advantage	0.574	0.116	0.832	0.147	0.829	
Trialability	0.62	0.049	0.995	0.072	0.825	0.903

3.1.3 Heterotrait-monotrait ratio (HTMT)

Table 4. Heterotrait-monotrait ratio (HTMT)

	Behavioral Intention to Adoption of LMS	Compatibility	Complexity	Observability	Relative Advantage	Trialability
Behavioural intention to Adoption of LMS						
Compatibility	0.229					
Complexity	0.665	0.081				
Observability	0.204	1.138	0.093			

Continued on next page

Table 4 continued

Relative Advantage	0.624	0.147	0.929	0.182	
Trialability	0.652	0.095	1.074	0.095	0.92

3.2 Structural Model

Table 5 displays the findings from the structural model used to test our suggested hypotheses. All hypotheses were accepted at a 5% significance level. All the accepted hypotheses had a significant positive effect and were confirmed by the literature. To evaluate the structural model, researchers⁽²⁴⁾ advocate looking at R^2 and model fit (See Table 6).

The model validity is mainly determined by looking at the structural paths and R^2 values because PLS does not produce an overall goodness-of-fit indicator (as with LISREL). The SRMR is the only approximate model fit requirement for evaluating PLS modelling, according to⁽¹⁷⁾, which is consistent with previous studies. The concept of model fit, as employed in CB-SEM research, applies to PLS-SEM applications. The concept of model fit is essential in CB-SEM, whereas it is less critical in PLS-SEM. SRMR = 0.091 indicates that our model fit is not significant.⁽¹⁸⁾ warn against focusing on it because the primary goal of the PLS approach is to forecast indicators using component expansion.

3.2.1 Path Coefficients and their significance

Table 5. Path coefficients and their significance

Hypo-theses	Path Coefficient	B	t	p-values	Results
H1	Relative Advantage -> Behavioral Intention to Adoption of LMS	0.140	2.946	0.003	supported
H2	Compatibility -> Behavioral Intention to Adoption of LMS	0.801	4.230	0.000	supported
H3	Complexity -> Behavioral Intention to Adoption of LMS	1.147	6.144	0.000	supported
H4	Trialability -> Behavioral Intention to Adoption of LMS	-0.629	3.58	0.000	supported
H5	Observability -> Behavioral Intention to Adoption of LMS	-0.641	3.573	0.000	supported

3.2.2 The results of R^2

Table 6. The results of R^2

	R Square
Behavioral Intention to Adoption of LMS	0.468

From the findings, Relative advantage has a strong impact on behavioral intention to adopt LMS ($p = 0.003$). Therefore, H1 is supported. Compatibility has a positive impact on behavioral intention to adopt LMS ($p = 0.000$). H2 is also supported. The p-value for complexity is 0.000; therefore, hypothesis H3 is also supported. Trialability has a p-value of 0.000, indicating that it has a strong impact on the adoption of LMS. H5 is also supported with a p-value of 0.000.

Figure 2 shows the estimate of the path coefficients of our model using SmartPLS following structural equation modelling. All the hypotheses are significant at the 0.05 level.

The study's primary goal was to investigate the elements that influence how university students use LMSs as learning platforms. The correlations between five parameters and students' intentions to use LMS platforms were examined based on the model that was suggested. Overall, the findings supported both the research model and the hypotheses. The findings of this study provide an understanding of the Innovation Diffusion Theory (IDT). The results showed that elements such as relative advantage, complexity, observability, triability, and compatibility have a stronger impact on students' intentions to utilise the LMS. This implies that our findings have the potential to improve students' university academic achievement. The findings also show that students may consider the LMS platforms useful if they can accommodate their learning needs. Hence, appropriate policies and strategies should be put in place to ensure that students find the LMS less complex, well-suited to their learning needs, and advantageous.

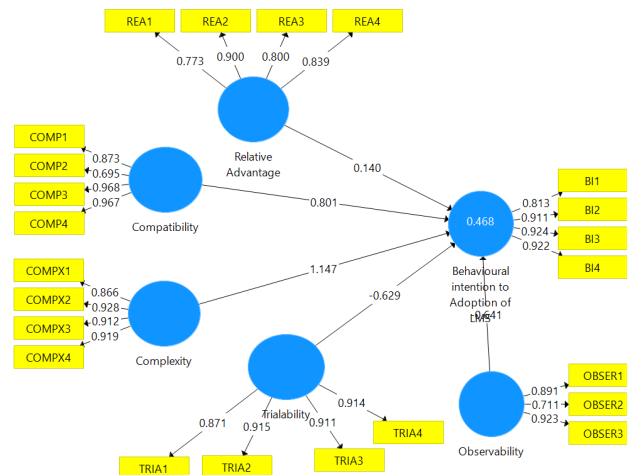


Fig 2. PLS results for structural model

Students may consider the LMS platforms' strategies advantageous and compatible if they can customize them to their specific learning needs. Students, on the other hand, can view LMS plans as more advantageous if they believe the LMS platforms to be superior to other traditional teaching methods. The findings suggest relative advantage and compatibility have positive and significant effects on the student's intention to use the LMS. This implies that the students of the University of Professional Studies, Accra, are already familiar with the LMS, which has a substantial bearing on their intentions to utilise it. The university should put in place innovative policies and strategies to lock in the students to the LMS.

3.3 Implications

The implications of our findings include (a) that students' performance in higher education can be improved by using the LMS for learning. Additionally, lecturers and supervisors should be responsible for assisting students in this regard by responding to their inquiries and effectively imparting knowledge. A faculty member's contribution in this way can help students study more effectively and strengthen their research abilities, and (b) technology and resources such as Smartphones, iPhones, tablets, laptops, the internet, and so on are critical factors to consider in the context of behavioral intention to use the LMS. This means that students should make use of the abundance of technology resources available to them because it can improve their learning performance.

3.4 Limitations

Despite being a significant study in the field of online learning, it has numerous shortcomings. One of the research's drawbacks is that only one university was used in the study, which makes it difficult to generalize the findings to other contexts in academic institutions. Another restriction is related to the type of data. The current study, in particular, did not look at qualitative data. Therefore, it is strongly advised that additional research be done in culturally diverse settings while taking these constraints into account.

4 Conclusion

This study's objective was to contribute to the small but growing body of research on the variables affecting the use of the LMS for blended or remote teaching and learning in higher education. The study focused on university students who had used the LMS for at least one academic year at UPSA. The findings show the diffusion of innovation theory can explain technology adoption. This theory has proven to be an adequate theoretical framework. It complemented the corpus of knowledge in this publication and was pertinent to the study's conclusions. The inclusion of its features increased student uptake, according to the diffusion of innovation theory. The most important factors influencing the adoption of LMS were Relative Advantage, Compatibility, Complexity, Trialability, and observability. These factors can all be used to forecast the students' adoption rate of innovation. As indicated in the opening of this work, we set out to investigate five concerns. It was discovered that LMS adoption by distance learning students is significantly influenced by Relative Advantage, Compatibility, Complexity, Trialability, and observability.

The characteristics of innovations also indicated a positive impact on the diffusion of innovations. Relative advantage had a positive impact (relative advantage \rightarrow behavioral intention to adopt LMS, $t = 2.946$, $p = 0.003$). Compatibility also had a positive impact (Compatibility \rightarrow behavioral intention to adopt LMS, $t = 4.23$, $p = 0.000$). Complexity, Trialability, and observability also had a positive impact on t and p -values, respectively ($t = 6.144$, $p\text{-value} = 0.000$, $t = 3.58$, $p\text{-value} = 0.000$, and $t = 3.573$, $p\text{-value} = 0.000$). The study recommends that the research be repeated at two or more universities in Ghana.

References

- 1) Pinho C, Franco M, Mendes L. Application of innovation diffusion theory to the E-learning process: higher education context. *Education and Information Technologies*. 2021;26(1):421–461. Available from: <https://doi.org/10.1007/s10639-020-10269-2>.
- 2) Asenahabi BM, Peters AI, Nambiro AW. Learning management system usability towards online learning: A literature review. *AU Institutional Repository*. 2022. Available from: <http://41.89.205.12/handle/123456789/1857>.
- 3) M C. Learning Management Systems (LMS) towards helping Teachers and Students in the pursuit of their E-Learning Methodologies . 2021. Available from: https://www.academia.edu/45620337/Learning_Management_Systems_LMS_towards_helping_Teachers_and_Students_in_the_pursuit_of_their_E_Learning_Methodologies.
- 4) Marie MJA, S. Improved pedagogical practices strengthens the performance of student teachers by a blended learning approach. *Social Sciences & Humanities Open*. 2021;4(1):100199. Available from: <https://doi.org/10.1016/j.ssaho.2021.100199>.
- 5) DLS. Distance Education. . Available from: <https://upsa.edu.gh/academics/schools-and-faculties/distance-learning-school/2022>.
- 6) Khan R, Dania A, Osman D, Gettins D. Diffusion of Innovation: Adoption of Learning Management System Technology in Emerging Market Economies. *Accounting and Finance Research*. 2020;10(1):1–1. Available from: <https://doi.org/10.5430/afr.v10n1p1>.
- 7) Kaisara G, Bwalya KJ. Investigating the E-Learning Challenges Faced by Students during Covid-19 in Namibia. *International Journal of Higher Education*;10(1):308. Available from: <https://eric.ed.gov/?id=EJ1285672#:~:text=An%20analysis%20of%20the%20study,student%20challenges%20with%20online%20classes>.
- 8) Cigdem H, Ozturk M. Factors Affecting Students' Behavioral Intention to Use LMS at a Turkish Post-Secondary Vocational School. 2022. Available from: <https://doi.org/10.19173/irrodl.v17i3.2253>.
- 9) Bervell B, Umar IN. Blended learning or face-to-face? Does Tutor anxiety prevent the adoption of Learning Management Systems for distance education in Ghana? *Open Learning: The Journal of Open, Distance and e-Learning*. 2020;35(2):159–177. Available from: <https://doi.org/10.1080/02680513.2018.1548964>.
- 10) Aldiab A, Chowdhury H, Kootsookos A, Alam F, Allhibi H. Utilization of Learning Management Systems (LMSs) in higher education system: A case review for Saudi Arabia. *Energy Procedia*. 2019;160:731–737. Available from: <http://dx.doi.org/10.1016/j.egypro.2019.02.186>.
- 11) Park CS. Revisiting the Two-Step Flow Model on Twitter: Interconnection of Self-Identified South Korean Twitter Opinion Leadership, News Consumption, News Links, and News Curation. *Electronic News*. 2019;13(2):63–77. Available from: <https://doi.org/10.1177/1931243118809780>.
- 12) Wo DXH, Schminke M, Ambrose ML. Trickle-Down, Trickle-Out, Trickle-Up, Trickle-In, and Trickle-Around Effects: An Integrative Perspective on Indirect Social Influence Phenomena. *Journal of Management*. 2019;45(6):2263–2292. Available from: <https://doi.org/10.1177/0149206318812951>.
- 13) Vargo SL, Akaka MA, Wieland H. Rethinking the process of diffusion in innovation: A service-ecosystems and institutional perspective. *Journal of Business Research*. 2020;116:526–534. Available from: <https://doi.org/10.1016/j.jbusres.2020.01.038>.
- 14) Al-Rahmi WM, Yahaya N, Aldraiweesh AA, Alamri MM, Aljarboa NA, Alturki U, et al. Integrating Technology Acceptance Model With Innovation Diffusion Theory: An Empirical Investigation on Students' Intention to Use E-Learning Systems. *IEEE Access*. 2019;7:26797–26809. Available from: <https://doi.org/10.1109/ACCESS.2019.2899368>.
- 15) Raman R, Mandal S, Das P, Kaur T, Jp S, Nedungadi P. University students as early adopters of ChatGPT: Innovation Diffusion Study. Research Square Platform LLC. 2023. Available from: <https://doi.org/10.21203/rs.3.rs-2734142/v1>.
- 16) Le M. Examining factors that boost intention and loyalty to use Fintech post-COVID-19 lockdown as a new normal behavior. *Heliyon*. 2021;7(8):e07821. Available from: <https://doi.org/10.1016/j.heliyon.2021.e07821>.
- 17) Arkorful V, Barfi KA, Baffour NO. Factors affecting use of massive open online courses by Ghanaian students. *Cogent Education*. 2022;9(1). Available from: <https://doi.org/10.1080/2331186X.2021.2023281>.
- 18) Mo PKH, Luo S, Wang S, Zhao J, Zhang G, Li L, et al. Intention to Receive the COVID-19 Vaccination in China: Application of the Diffusion of Innovations Theory and the Moderating Role of Openness to Experience. *Vaccines*. 2021;9(2):129. Available from: <https://doi.org/10.3390/vaccines9020129>.
- 19) Noor R, Rasoolimanesh MS, Jaafar SM, Barghi M. Inscription of a destination as a world heritage site and residents' perceptions. *Asia Pacific J Tour Res*. 2019;24(1). Available from: <https://doi.org/10.1080/10941665.2018.1541183>.
- 20) Hair JF, Risher JJ, Sarstedt M, Ringle CM. When to use and how to report the results of PLS-SEM. *European Business Review*. 2019;31(1):2–24. Available from: <https://doi.org/10.1108/EBR-11-2018-0203>.
- 21) Shmueli GM, Sarstedt M, Hair JF, Cheah JHF, Ting HH, Vaithilingam S, et al. Predictive model assessment in PLS-SEM: guidelines for using PLSpredict. *European Journal of Marketing*. 2019;53(11):2322–2347. Available from: <https://doi.org/10.1108/EJM-02-2019-0189>.
- 22) Ogbeibu S, Jabbar CJC, Gaskin J, Senadjki A, Hughes M. Leveraging STARA competencies and green creativity to boost green organisational innovative evidence: A praxis for sustainable development. *Business Strategy and the Environment*. 2021;30(5):2421–2440. Available from: <https://doi.org/10.1002/bse2754>.
- 23) Palos-Sanchez, Robina-Ramirez, Velicia-Martin. What Role does Corporate Governance Play in the Intention to Use Cloud Computing Technology? *Symmetry*. 2019;11(10):1253. Available from: <https://doi.org/10.3390/sym11101253>.
- 24) Aina AY, Ogegbu AA. Teaching and Assessment through Online Platforms during the COVID-19 Pandemic: Benefits and Challenges. *Journal of Education and e-Learning Research*. 2021;8(4):408–415. Available from: <https://doi.org/10.20448/journal.509.2021.84.408.415>.