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Extending the UTAUT Model with Service Quality to Assess Moodle LMS Acceptance in Ghanaian Colleges of Education

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ABSTRACT

This study aimed to increase understanding of how the Unified Theory of Acceptance and Use of Technology (UTAUT) constructs and service quality of Moodle Learning Management System (LMS) influence its acceptance among college of education students. The UTAUT model was extended to include service quality, capturing technical support, system reliability, and user satisfaction, which is crucial in Ghanaian Colleges of Education, where LMS effectiveness depends on institutional support and service delivery. The study was guided by three research questions examining students' perceptions of key UTAUT constructs, service quality, behavioural intention, and use behaviour in relation to Moodle LMS in Ghanaian Colleges of Education. It also explored the influence of performance expectancy, effort expectancy, and social influence on behavioural intention, as well as the effects of facilitating conditions, service quality, and behavioural intention on actual use behaviour. A descriptive and confirmatory cross-sectional survey design was employed for the study. Multi-stage sampling approach was used to select a sample of 382 students for the research. A questionnaire was designed to assess students' perceptions of performance expectancy, effort expectancy, social influence, facilitating conditions, service quality, behavioural intention, and use behaviour. Structural Equation Modelling (SEM) was used to analyse relationships of the effects of UTAUT constructs and service quality on behavioural intentions and use behaviour. The results indicated a positive but weak influence of performance expectancy and effort expectancy on behavioural intentions. Social influence, however, had a strong effect on behavioural intentions while service quality had a moderate effect on use behaviour of students to use Moodle LMS. The study suggests that colleges of education should prioritize strategies that leverage social influence, such as peer support and instructor endorsements as well as the service quality, to enhance students' intentions to use Moodle LMS.

Keywords: Moodle, UTAUT, technology acceptance, learning management system, service quality

INTRODUCTION

The topic of eLearning has gained the attention of researchers and other stakeholders in the field of education in the past few decades. Learning Management System (LMS), which is an integral tool in today's eLearning programs, facilitates the delivery, management, and administration of learning activities and resources. These web-based platforms provide a centralized system for instructors to create, deliver, and track educational content, as well as for students to access course materials, submit assignments, and participate in online discussions (Almpanis, 2015; Tarhini et al., 2017). One of the most widely used LMS is Moodle (Modular Object-Oriented Dynamic Learning Environment), an open-source software that has gained substantial popularity in academic institutions around the world. Moodle offers a comprehensive set of tools and features that support various pedagogical approaches, including the creation of online courses, the integration of multimedia resources, the facilitation of collaborative learning, and the implementation of assessment strategies (Machado & Tao, 2007; Naveh et al., 2012).

The increase in the popularity of Moodle in educational contexts has been driven by several factors, such as the need to cater to the changing learning choices of students, the desire to enhance the flexibility and accessibility of educational content, and the recognition of the potential benefits of online and blended learning models (Al-Busaidi & Al-Shihi, 2012; Mtebe, 2015). LMS platforms have the capacity to enhance the quality of administrative tasks, provide interactive learning experiences, and provide estimable data analytics to inform decision-making processes (Machado & Tao, 2007; Naveh et al., 2012). As the use of LMS continues to increase in educational institutions, it becomes more important to comprehend the factors that determine the adoption and use of these technologies by both students and faculty. The successful implementation and continuous usage of LMS platforms can have major implications for the quality of teaching and learning, as well as the overall efficacy of the educational experience (Almpanis, 2015; Tarhini et al., 2017). Several models exist for measuring the acceptance and use of IT systems. Notable among them are the technology acceptance model (Davis, 1989), the theory of planned behaviour Ajzen (1991), and the Unified Theory of Acceptance and Use of Technology (UTAUT) Venkatesh et al. (2003). The UTAUT model provides an exhaustive framework for understanding the factors that influence the adoption and usage of technology, such as LMSs (Venkatesh et al., 2003). The model spells out four key determining factors of technology acceptance and use: performance expectancy, effort expectancy, social influence, and facilitating conditions. In the context of Moodle LMS usage in educational contexts, the UTAUT model can be a valuable tool for assessing the factors that contribute to the effective adoption and utilization of this learning platform (Musa et al., 2005; Tarhini et al., 2017). Performance expectancy refers to the degree to which users believe that Moodle will enhance their academic performance and learning outcomes. Effort expectancy relates to the perceived ease of use and interaction with the Moodle system. Social influence comprises the degree to which users perceive that important individuals or groups within their social network support the use of Moodle. Facilitating conditions refer to the availability of organizational and technical resources to support the use of Moodle LMS (Mtebe & Raisamo, 2014; Venkatesh et al., 2003). By applying the UTAUT model to the study of Moodle LMS usage in Ghanaian colleges of education, researchers can gain estimable insights into the factors that compel or impede the adoption and continued use of this learning platform (Mtebe & Raisamo, 2014; Tarhini et al., 2017). Understanding these factors can inform the development of targeted strategies and interventions to improve the quality and efficacy of Moodle LMS implementation within these educational institutions (Mtebe, 2015). This study will employ the UTAUT model to find the extent to which the acceptance and quality of Moodle LMS influence learning outcomes. It will also, among other benefits provide the opportunity to explain the intentions of CoE students to use Moodle LMS and predict subsequent behaviours using UTAUT as a framework. The study will therefore provide an estimable tool that enables CoE decision makers, faculty members, and designers to understand the factors propelling e-learning system acceptance and thus facilitate the adoption of the system by students.

Problem Statement

Despite the widespread adoption of the Moodle Learning Management System (LMS) in academic institutions worldwide, several studies indicate that its effective use remains limited. Mtebe and Raisamo (2014) examined factors influencing the adoption and use of Moodle in higher education institutions in Tanzania and found that, although the system was available, its integration into teaching and learning activities was relatively low. Key barriers included inadequate computer and internet infrastructure, limited technical support, and low levels of digital literacy among both faculty and students. These challenges are closely related to facilitating conditions and effort expectancy, as they affect users' perceptions of the ease and feasibility of using the system. Similarly, Naveh et al. (2012) investigated factors contributing to low Moodle usage at an Israeli university and reported that many faculty members relied mainly on basic system features, despite the availability of more advanced functionalities. Factors such as lack of training, time constraints, and resistance to change influenced users' willingness to engage fully with the system. These findings reflect the roles of effort expectancy, social influence, and behavioural intention in shaping technology acceptance. Cigdem and Topcu (2015) explored challenges faced by instructors in using Moodle at a Turkish university and found that, although instructors demonstrated positive attitudes toward the system, inadequate technical support, insufficient training, and difficulties in aligning Moodle with pedagogical practices hindered its effective use. These constraints are indicative of weak facilitating conditions and perceived service quality, which can negatively affect both behavioural intention and actual use behaviour. Likewise, Tarus et al. (2015) examined Moodle implementation in Kenyan universities and observed low levels of adoption and active usage among faculty members, despite institutional availability. The study identified limited infrastructure, insufficient technical support, low digital literacy, and resistance to change as major barriers. These factors correspond to facilitating conditions, effort expectancy, and social influence, which are central constructs in the Unified Theory of Acceptance and Use of Technology (UTAUT). Collectively, existing studies indicate that the effective adoption and utilization of Moodle LMS are shaped by multiple interrelated factors, including performance expectancy, effort expectancy, social influence, facilitating conditions, and service quality. Within the Unified Theory of Acceptance and Use of Technology (UTAUT) framework, these constructs influence users' behavioural intentions, which subsequently determine actual use behaviour.

Building on these empirical insights, the present study proposes an integrative conceptual model in which performance expectancy, effort expectancy, and social influence are conceptualized as key antecedents of students' behavioural intention to use Moodle LMS. Behavioural intention, in turn, is posited to directly influence actual use behaviour. Additionally, facilitating conditions and service quality are hypothesized to exert both direct and indirect effects on use behaviour by supporting users' capacity and motivation to engage with the system. Accordingly, the model assumes that students' acceptance and sustained use of Moodle LMS in Ghanaian Colleges of Education are jointly determined by cognitive, social, institutional, and technological factors. This integrative framework provides a coherent basis for examining the structural relationships among the study variables and for testing the pathways through which they influence technology acceptance and usage.

Research Questions

The following research questions guided the study:

- What are the levels of students' perceptions of performance expectancy, effort expectancy, social influence, facilitating conditions, service quality, behavioural intention, and use behaviour in relation to the use of the Moodle learning management system in Colleges of Education in Ghana?
- What is the influence of performance expectancy, effort expectancy, and social influence on the behavioural intentions of students to use Moodle LMS?

- What is the influence of facilitating conditions, service quality, and behavioural intention on the use behaviour of students in the use of Moodle LMS?

Hypothesis

H_0 - There is no positive influence of performance expectancy, effort expectancy, and social influence on behavioural intentions, as well as of facilitating conditions, service quality, and behavioural intentions on the use behaviour of Moodle LMS among CoE students.

H_1 - There is a positive influence of performance expectancy, effort expectancy, and social influence on behavioural intentions, as well as of facilitating conditions, service quality, and behavioural intentions on the use behaviour of Moodle LMS among CoE students.

LITERATURE REVIEW

The adoption of LMS like Moodle in educational institutions has become increasingly common with the objective of enhancing the quality of teaching and learning processes. In Ghana, colleges of education are integrating Moodle LMS to provide a more manageable and all-encompassing learning environment. To assess the efficiency and quality of Moodle LMS usage, the UTAUT model, together with the service quality construct, serves as an effective/efficient framework. This literature review examines the application of the UTAUT model to assess Moodle LMS in Ghanaian colleges of education.

The UTAUT Model

The Unified Theory of Acceptance and Use of Technology (UTAUT), originally proposed by Venkatesh et al. (2003), integrates key elements from eight prominent technology acceptance models, including the Technology Acceptance Model (TAM), the Theory of Planned Behavior (TPB), and the Diffusion of Innovation (DOI) theory. Since its development, UTAUT has been extensively applied and extended in educational technology research to explain users' acceptance and continued use of LMS such as Moodle (Dwivedi et al., 2019; Tamilmani et al., 2021; Venkatesh et al., 2012). Empirical studies consistently demonstrate that performance expectancy remains one of the strongest predictors of LMS adoption. Recent research indicates that students and instructors are more likely to embrace Moodle when they perceive it as enhancing learning efficiency, academic achievement, and instructional effectiveness (Almaiah et al., 2019; Salloum et al., 2019). These findings suggest that perceived academic and professional benefits serve as primary motivational drivers in technology acceptance across educational contexts. Similarly, effort expectancy has been identified as a critical determinant of technology adoption, particularly in institutions where users exhibit diverse levels of digital competence. Contemporary studies emphasize that intuitive system design, ease of navigation, and technical simplicity significantly promote positive user perceptions and sustained engagement (Al-Rahmi et al., 2022a; 2022b; Raza et al., 2020). This body of research indicates that usability functions not merely as a technical attribute but also as a psychological facilitator of learning technology adoption. Beyond individual perceptions, social influence has been shown to exert a substantial impact on users' behavioural intentions. Recent investigations reveal that peer interactions, instructors' encouragement, and institutional expectations significantly shape attitudes toward Moodle usage, particularly in developing-country contexts (Tarhini et al., 2017; Yakubu & Dasuki, 2018). These studies highlight the importance of social and organizational environments in reinforcing technology-related behaviours. Facilitating conditions further complement psychological and social factors by providing the structural foundation necessary for effective system utilization. Evidence from recent studies indicates that access to reliable internet connectivity, technical support, training opportunities, and institutional policies enhances users' ability to translate intentions into actual usage (Almaiah et al., 2020; Boateng et al., 2023). Inadequate infrastructural support, on the other hand, has been identified as a major barrier to sustained LMS engagement in many developing educational systems.

Behavioural intention continues to emerge as a central mediating construct within the UTAUT framework. Contemporary empirical studies confirm that performance expectancy, effort expectancy, social influence, and facilitating conditions primarily influence use behaviour through behavioural intention (Chiu et al., 2023; Tamilmani et al., 2021; Venkatesh et al., 2012). This reinforces the theoretical proposition that intention serves as the principal mechanism through which users' perceptions are transformed into actual technology use. Use behaviour, which reflects the extent, frequency, and depth of interaction with Moodle LMS, is largely determined by the combined effects of behavioural intention and facilitating conditions. Recent research demonstrates that when users possess strong intentions and adequate institutional support, they are more likely to engage in consistent and meaningful system use (Al-Rahmi et al., 2022b; Boateng et al., 2023; Naveed et al., 2020). Such sustained engagement has been linked to improved learning outcomes and instructional effectiveness. Overall, prior studies reveal a consistent pattern in which LMS adoption is shaped by the interaction of perceived usefulness, ease of use, social reinforcement, and institutional support. While these findings validate the robustness of the UTAUT model across diverse educational settings, existing literature has largely focused on universities and online learning environments in developed contexts. Limited empirical attention has been given to colleges of education and teacher-training institutions in sub-Saharan Africa, particularly Ghana. Moreover, few studies have examined how professional training demands and pedagogical expectations influence technology acceptance within these institutions. This gap underscores the need for context-specific research that applies and extends the UTAUT framework to better understand Moodle LMS adoption among trainee teachers.

Conceptual Framework: UTAUT with Service Quality

To provide an exhaustive assessment of Moodle LMS usage, the conceptual framework integrates service quality as an additional construct. Service quality in the context of LMS refers to the total support and resources provided to warrant an optimal user experience. This includes technical support, system reliability, and user satisfaction. It is an important factor in the successful implementation of educational technologies. Studies have revealed that high service quality leads to increased user satisfaction and continued usage of LMS (Lin et al., 2020). The addition of service quality in the UTAUT model gives way to a more holistic evaluation of Moodle LMS, considering not only the technological aspects but also the quality of support services given. Research on Moodle LMS effectiveness in Ghanaian institutions shows mixed results. Previous studies present mixed evidence regarding the effectiveness of Moodle LMS in educational settings. While Al-Fraihat et al. (2020) found that Moodle usage significantly enhances students' engagement and learning outcomes when adequate support systems are in place, Arkorful and Abaidoo (2015) reported that insufficient technical support and poor infrastructural facilities constitute major barriers to effective implementation. These contrasting findings suggest that the success of Moodle LMS is largely dependent on the quality of institutional support and service delivery mechanisms. Consequently, the integration of service quality into the UTAUT model provides a comprehensive and systematic framework for examining how technological, organisational, and support-related factors jointly influence users' acceptance and sustained use of Moodle LMS. **Figure 1** illustrates the conceptual framework.

Addressing Challenges to Moodle LMS Adoption in Ghana: Insights from UTAUT and Comparative Studies

Recent studies indicate that although the application of the UTAUT model to Moodle LMS usage in Ghanaian colleges of education remains limited, broader research on technology acceptance in Ghana and similar contexts provides valuable insights into key facilitators and barriers. Contemporary evidence suggests that the adoption of educational technologies in sub-Saharan Africa continues to be shaped by infrastructural constraints, institutional capacity, digital literacy levels, and socio-economic conditions (Boateng et al., 2021; Tondeur et al., 2021). While earlier studies reported generally positive attitudes toward technology integration,

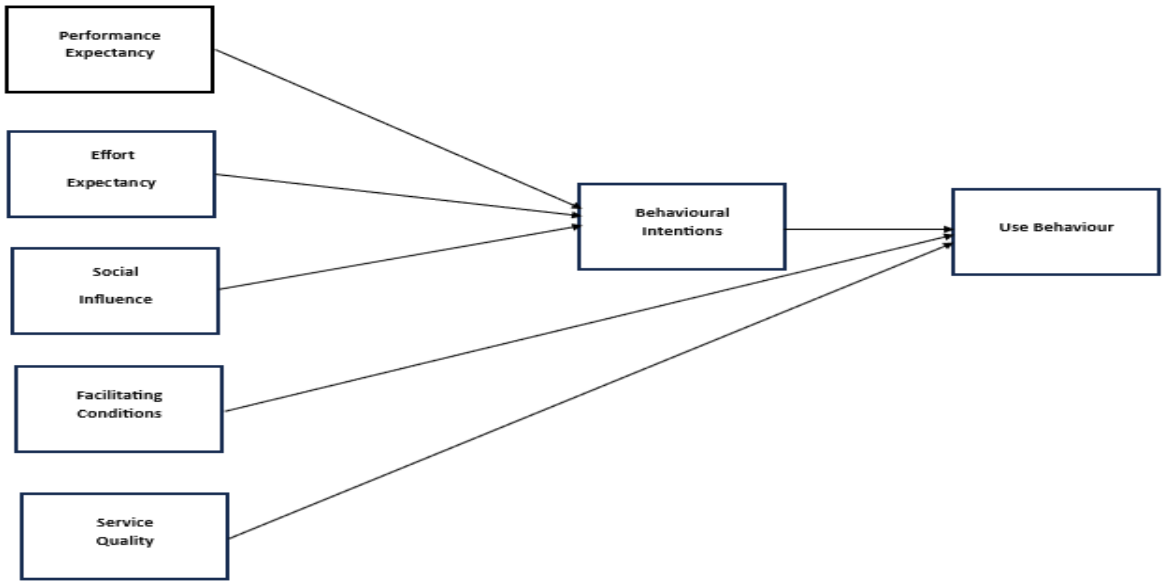

Figure 1. Conceptual Framework of UTAUT with Service Quality

persistent challenges relating to unreliable internet connectivity, limited technical support, and inadequate training remain prevalent (Aboagye et al., 2020; Buabeng-Andoh, 2012). More recent empirical investigations in Ghanaian and African higher education contexts have reaffirmed the relevance of UTAUT constructs in explaining LMS adoption. For instance, Aboagye et al. (2020) found that performance expectancy, effort expectancy, and facilitating conditions significantly influenced students' and lecturers' intentions to use LMS platforms during the COVID-19 pandemic. Similarly, Boateng et al. (2021) reported that social influence and institutional support played critical roles in sustaining online learning practices in Ghanaian universities. These findings highlight the increasing importance of organisational readiness and leadership commitment in technology adoption processes. Comparative studies from neighbouring countries further strengthen these observations. In Nigeria, Adeoye et al. (2020) demonstrated that performance expectancy, system usability, and technical support were strong predictors of LMS acceptance among university staff and students. Likewise, Al-Rahmi et al. (2022a), in a multi-country African study, confirmed that facilitating conditions and digital competence significantly shaped behavioural intention and actual usage of e-learning systems. These studies collectively suggest that while individual perceptions remain important, institutional and infrastructural factors are equally decisive. Across recent literature, several recurring challenges to effective LMS implementation have been identified, including inadequate technological infrastructure, insufficient professional development opportunities, low levels of digital literacy, and resistance to pedagogical change (Aboagye et al., 2020; Adeoye et al., 2020). In response, scholars increasingly emphasize the need for comprehensive capacity-building programmes, continuous technical support, and the establishment of supportive organisational cultures that promote innovation and collaboration (Boateng et al., 2021; Tondeur et al., 2021). Synthesizing these findings, it is evident that successful Moodle LMS adoption in Ghanaian colleges of education depends on the interaction between individual, technological, and institutional factors. Performance expectancy and ease of use motivate initial acceptance, while sustained usage is largely influenced by facilitating conditions, service quality, and leadership support. Lessons from regional and international studies indicate that targeted investments in infrastructure, systematic training initiatives, and participatory implementation strategies are essential for overcoming persistent barriers. Consequently, integrating these best practices into the Ghanaian context can enhance the effectiveness, sustainability, and equitable use of Moodle LMS across colleges of education.

METHOD

The study employed a descriptive and confirmatory cross-sectional survey research design to examine how the Unified Theory of Acceptance and Use of Technology (UTAUT) constructs and service quality influence the acceptance of the Moodle Learning Management System among Colleges of Education (CoE) students in Ghana. This design was considered appropriate because the study sought to capture students' perceptions, attitudes, and usage behaviours at a specific point in time without manipulating any variables. The descriptive cross-sectional survey component enabled the researchers to systematically collect quantitative data on key variables, including performance expectancy, effort expectancy, social influence, facilitating conditions, service quality, behavioural intention, and use behaviour. This approach provided a comprehensive overview of the current level of Moodle LMS acceptance and usage among students, thereby aligning with the study's objective of understanding existing patterns and relationships within the population. The confirmatory aspect of the design was particularly suitable for testing the theoretically grounded UTAUT-based model and the formulated hypotheses. Since the study was guided by established constructs and clearly specified causal relationships, a confirmatory approach allowed for the empirical validation of these relationships using statistical techniques. In line with Creswell and Creswell (2017), this approach supports theory testing by examining whether observed data fit a predefined conceptual framework.

Furthermore, the cross-sectional nature of the design was appropriate because the study aimed to assess students' acceptance of Moodle LMS at a particular stage of implementation within the Colleges of Education. This facilitated the examination of the direct and indirect effects of performance expectancy, effort expectancy, social influence, facilitating conditions, and service quality on behavioural intention and actual use behaviour at a single time point. The use of survey methodology was also justified because it enabled the efficient collection of standardized data from a relatively large sample, thereby enhancing the generalizability of the findings. In addition, the integration of Structural Equation Modelling (SEM) within this design strengthened the confirmatory approach by allowing for the simultaneous testing of multiple relationships among latent variables, as specified in the study hypotheses. Overall, the descriptive and confirmatory cross-sectional survey design was appropriate for achieving the study objectives and testing the hypotheses, as it facilitated the systematic examination of theoretically derived relationships among UTAUT constructs, behavioural intention, and use behaviour in the context of Moodle LMS adoption among CoE students. A quantitative approach using questionnaire with numerically rated items was used to collect data for the research. "Quantitative research is the numerical representation and manipulation of observations for the purpose of describing and explaining the phenomena that those observations reflect." (Babbie, 2016).

Population, Samples, & Sampling Procedure

The study used a multi-stage sampling method to select 382 students from a population of 53,320 in the colleges of education in Ghana. First, purposive sampling was used to select 12 colleges. The primary justification for selecting these 12 colleges was their active use of the Moodle platform for eLearning during the COVID-19 period. This ensures that the participants have the necessary lived experience to provide meaningful data on system acceptance and service quality. Secondly, stratified random sampling was used to select respondents from the selected colleges. The stratification was based on the students' programme of study; Upper Primary (n= 92), Early Grade (n= 85) and JHS (n= 205). Participants for the study were required to meet specific inclusion criteria. Only registered full-time students enrolled in the selected programmes who had actively used Moodle LMS during their coursework and were willing to provide informed consent were considered eligible to participate. Conversely, students who were on leave or absent during the data collection period, as well as those who had not engaged with Moodle LMS and therefore lacked sufficient experience to respond meaningfully, were excluded from the study. Data collection was conducted during the academic semester in the selected Colleges of Education after obtaining permission from institutional authorities. Data

collection was done by the researchers at the various campuses of the study. Prior to administration, participants were informed about the purpose of the study, assured of confidentiality and anonymity, and notified that participation was voluntary. Informed consent was obtained from all participants before data collection commenced. Completed questionnaires were collected immediately, checked for completeness, and securely stored for data analysis. Frequency counts and percentages were used to analyse the background data of respondents. Regression analyses and modelling were done with the help of AMOS software. To make sure the items on the questionnaire adhered to face and content validity standards, they were submitted to two subject matter experts for evaluation. Additionally, a pilot study was conducted at one college of education, with the results excluded from the primary investigation. The questionnaire for the pilot study received a response rate of 85%. The results of the pilot study were assessed to evaluate the instrument's dependability. The Cronbach's alpha coefficient was employed to assess the internal reliability of the questionnaire and was found to be 0.80. This suggests that all the elements comprising the individual questionnaire items on the questionnaire have acceptable and good reliability (George & Mallery, 2019). Data were collected using a structured questionnaire adapted from validated UTAUT instruments and service quality measures. The questionnaire contained items assessing performance expectancy, effort expectancy, social influence, facilitating conditions, service quality, behavioural intention, and use behaviour of Moodle LMS. Prior to its administration, the questionnaire was pre-tested with a small pilot group of students from a non-selected college to ensure clarity, relevance, and reliability of the items.

Data analysis will be conducted in line with the descriptive and confirmatory cross-sectional design and the study's hypotheses. First, descriptive statistics, including frequencies and percentages, will be used to summarize respondents' demographic characteristics. This will provide an overview of the sample and support the descriptive objective of the study. Second, Structural Equation Modelling (SEM)-based regression analysis will be employed to test the hypothesised relationships among the study variables. Specifically, the effects of performance expectancy, effort expectancy, and social influence on behavioural intention, as well as the influence of facilitating conditions, service quality, and behavioural intention on use behaviour, will be examined. Path coefficients, standard errors, critical ratios, and p-values will be used to assess the strength and significance of these relationships. Third, correlation analysis will be conducted to examine multicollinearity among independent variables and to validate the proposed model. The absence of high intercorrelations will confirm the suitability of the model for regression analysis. This analytical strategy will align with the study design and objectives by enabling the systematic description of respondents' characteristics and the confirmatory testing of theory-driven hypotheses derived from the UTAUT framework.

RESULTS

Background Information on Respondents

This part of the analysis provides information on the characteristics of the respondents. It includes data on the gender and age of respondents. The demographic characteristics of respondents were analyzed in terms of gender and age. **Table 1** presents the gender distribution, indicating that 175 (45.81%) respondents were male, while 207 (54.18%) were female. The total sample size was 382 students.

Table 1. Gender Distribution of Respondents

Gender	Frequency	Percent
Male	175	45.81
Female	207	54.18
Total	382	100.00

Table 2. Age Distribution of Respondents

Age	N	N%
16-19	4	1.05
20-23	165	43.19
24-27	144	37.70
28 and above	69	18.06
Total	382	100.00

Table 3. Descriptive Statistics for UTAUT Constructs

Variable	N	Mean (M)	SD	Interpretation
Performance Expectancy	382	3.21	0.74	Moderate
Effort Expectancy	382	3.05	0.69	Moderate
Social Influence	382	4.12	0.61	High
Facilitating Conditions	382	3.18	0.72	Moderate
Service Quality	382	3.67	0.66	High
Behavioural Intention	382	3.89	0.63	High
Use Behaviour	382	3.54	0.70	Moderate–High

Table 4. Results of Normality Tests

Variable	Shapiro–Wilk (p-value)	Kolmogorov–Smirnov (p-value)	Decision
Performance Expectancy	> 0.05	> 0.05	Normal
Effort Expectancy	> 0.05	> 0.05	Normal
Social Influence	> 0.05	> 0.05	Normal
Facilitating Conditions	> 0.05	> 0.05	Normal
Service Quality	> 0.05	> 0.05	Normal
Behavioural Intention	> 0.05	> 0.05	Normal
Use Behaviour	> 0.05	> 0.05	Normal

Note: A p-value greater than 0.05 indicates that the data do not significantly deviate from a normal distribution.

Table 2 shows the age distribution of respondents. The majority of participants (43.19%) were between 20 and 23 years, followed by those aged 24–27 years (37.70%). Respondents aged 28 years and above constituted 18.06%, while those between 16 and 19 years formed 1.05% of the sample. **Table 3** presents the descriptive statistics of the study variables. Performance Expectancy (M = 3.21, SD = 0.74), Effort Expectancy (M = 3.05, SD = 0.69), and Facilitating Conditions (M = 3.18, SD = 0.72) recorded moderate mean values. Social Influence

(M = 4.12, SD = 0.61), Service Quality (M = 3.67, SD = 0.66), and behavioural intention (M = 3.89, SD = 0.63) recorded high mean values. Use behaviour recorded a moderate-to-high mean score (M = 3.54, SD = 0.70).

Test of Normality

Normality tests were conducted using the Shapiro–Wilk and Kolmogorov–Smirnov tests. As presented in **Table 4**, all variables recorded p-values greater than 0.05, indicating that the data did not significantly deviate from a normal distribution. Visual inspection of histograms and Q–Q plots also showed approximately symmetrical distributions.

Regression Analysis of Independent Variables on BI and UB

Regression analysis was carried out to find the influence of the independent variables on the dependent variables. Regression analysis was conducted to determine the influence of independent variables on behavioral intention and use behavior. **Table 5** presents the regression statistics. Performance expectancy had a weak positive influence on behavioral intention (R^2 = 0.05, p = 0.179). Effort expectancy also had a weak influence (R^2 = 0.02, p = 0.529). Social Influence had a strong influence on Behavioral Intention (R^2 = 0.72). Behavioural intention significantly influenced use behaviour (R^2 = 0.42, p = 0.001). Service quality had a moderate-to-strong influence on use behaviour (R^2 = 0.46, p = 0.001). Facilitating conditions showed a weak influence on use behaviour (R^2 = 0.04, p = 0.259). The resultant model is presented in **Figure 2**.

Definition of Bil and Ubl in This Study

In the context of this research on students' acceptance of the Moodle Learning Management System in Colleges of Education in Ghana, biL and ubL represent the latent disturbance (error) terms associated with Behavioral Intention (BI) and Use Behaviour (UB), respectively. The biL refers to the portion of students' Behavioral Intention to use Moodle that is not explained by the core UTAUT constructs—performance expectancy, effort expectancy, social influence, facilitating conditions, and service quality. It captures the effects of unmeasured personal, institutional, technological, and contextual factors, as well as random measurement error, that may influence students' intention to adopt and use the Moodle platform. Similarly, the ubL denotes the unexplained variance in students' actual use behaviour of Moodle that remains after accounting for the influence of behavioral intention, facilitating conditions, and service quality. It reflects the impact of external influences such as access to devices, internet stability, academic workload, technical support availability, and individual learning preferences that are not explicitly included in the model.

Table 5. Regression Statistics of Moodle LMS among CoE Students

Construct			R^2 Estimate	S.E.	C.R.	P	Label
BI	<---	PE	0.05	0.04	1.345	0.179	
BI	<---	EE	0.02	0.03	0.629	0.529	
BI	<---	SI	0.72	0.05	11.50	***	
UB	<---	BI	0.42	0.04	9.579	0.001	
UB	<---	SQ	0.46	0.04	10.310	0.001	
UB	<---	FC	0.04	0.03	1.128	0.259	

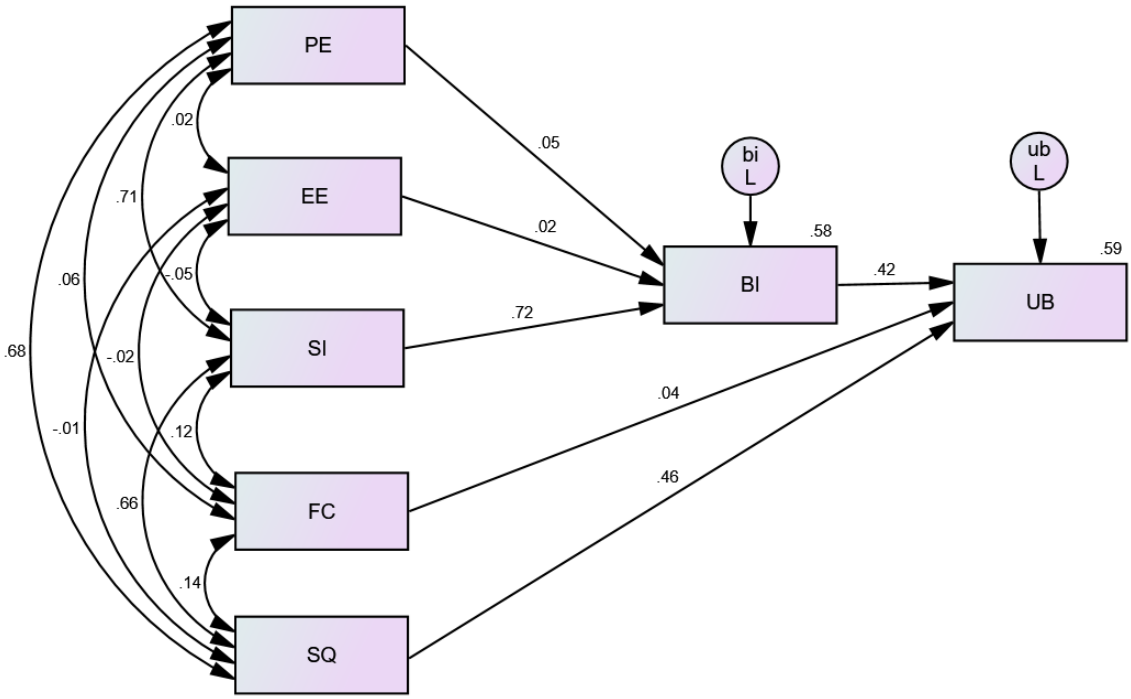

Figure 2. Resultant Model of CoE Students' Acceptance of Moodle LMS

Correlation and multicollinearity analysis results are presented in **Table 6**. Most independent variables showed weak to moderate correlations. Strong positive correlations were observed between performance expectancy and social influence (r = .713), performance expectancy and service quality (r = .682), and social influence and service quality (r = .660). The results indicate the absence of severe multicollinearity among predictors.

Hypothesis Testing

Hypothesis testing revealed that all R^2 values were positive: PE→BI (0.05), EE→BI (0.02), SI→BI (0.72), SQ→UB (0.46), FC→UB (0.04), and BI→UB (0.42). The results indicate positive relationships between independent and dependent variables. Consequently, the alternative hypotheses were accepted.

DISCUSSION

This study examined students' acceptance and use of the Moodle Learning Management System in Colleges of Education in Ghana using the Unified Theory of Acceptance and Use of Technology (UTAUT) model. The discussion focuses on the demographic characteristics of respondents, students' perceptions of Moodle, the determinants of behavioural intention and use behaviour, and the implications of the structural model.

Demographic Characteristics of Respondents

The age distribution of respondents indicates that the majority of participants were between 20 and 23 years, followed by those aged 24 to 27 years. This pattern reflects the typical age structure of students in Ghanaian tertiary institutions. The findings are consistent with national data reported by the National Council for Tertiary

Table 6. Model Validation—Regression and Multicollinearity

Independent Variable		Independent Variable	Estimate	Interpretation
PE	<-->	EE	.020	Almost no correlation; PE (Performance Expectancy) and EE (Effort Expectancy) are practically independent.
SI	<-->	EE	-.050	Very weak negative correlation; not practically significant.
SI	<-->	FC	.373	Moderate positive correlation; higher social influence (SI) is associated with higher facilitating conditions (FC).
SQ	<-->	FC	.141	Weak positive correlation between Service Quality (SQ) and FC.
PE	<-->	SQ	.682	Strong positive correlation; as PE increases, SQ tends to increase significantly.
SI	<-->	SQ	.660	Strong positive correlation; SI and SQ are closely related.
SQ	<-->	EE	-.011	Practically no correlation between SQ and EE.
EE	<-->	FC	.023	Almost no correlation between EE and FC.
PE	<-->	FC	.062	Very weak positive correlation.
PE	<-->	SI	.713	Strong positive correlation; PE and SI are strongly associated.

Education (2018), which identifies the dominant tertiary education age group as 19–23 years. Similarly, Hanson (2025) reported that the average age of full-time undergraduate students is 22 years. These consistencies suggest that the sample used in this study is representative of the general population of students in Colleges of Education, thereby enhancing the generalizability of the findings. The gender distribution, which showed a slightly higher proportion of female students, also reflects current enrollment trends in Ghanaian Colleges of Education. This demographic composition provides a relevant context for interpreting students' perceptions and usage of the Moodle platform.

Students' Perceptions of Moodle LMS

The descriptive statistics revealed that students' perceptions of Moodle varied across the UTAUT constructs. Performance Expectancy and Effort Expectancy recorded moderate mean values, indicating that students moderately perceived Moodle as useful and easy to use. Although respondents acknowledged the academic benefits of the platform, the moderate rating suggests that its instructional potential has not been fully exploited. This may be attributed to limited integration of Moodle into teaching practices, insufficient interactive content, and variations in lecturers' pedagogical approaches. Similarly, the moderate rating of Effort Expectancy implies that while most students are able to navigate the system, some usability challenges persist. These challenges may stem from inconsistent internet connectivity, limited access to digital devices, and varying levels of digital literacy. The findings highlight the need for continuous training and system optimization to enhance students' learning experiences. Social Influence recorded the highest mean score among the constructs, indicating that students' use of Moodle is strongly shaped by the opinions and expectations of lecturers, peers, and institutional authorities. In Ghanaian Colleges of Education, where

instructional practices are often instructor-led, social endorsement plays a crucial role in technology adoption. This underscores the importance of institutional leadership and lecturer commitment in promoting sustained LMS usage.

Facilitating conditions were rated at a moderate level, suggesting that technical infrastructure and institutional support are adequate but not optimal. Although basic facilities are available, gaps in internet reliability, technical assistance, and system maintenance may constrain effective usage. In contrast, service quality recorded a high mean score, reflecting positive perceptions of system reliability, responsiveness, and security. High service quality is essential for fostering trust and long-term engagement, suggesting that Moodle is technically capable of supporting instructional activities. Behavioral intention was rated highly, indicating students' strong willingness to continue using Moodle. However, Use behaviour recorded a moderate-to-high mean score, suggesting that actual usage does not always match students' intentions. This discrepancy may be influenced by external constraints such as limited access to devices, connectivity challenges, and insufficient course-related activities on the platform.

Determinants of Behavioural Intention

The regression results indicate that performance expectancy and effort expectancy had weak positive influences on behavioral intention. Although previous studies have identified performance expectancy as a key predictor of technology adoption (Chao, 2019; Wei et al., 2024), the weak effect observed in this study aligns with findings by Fadzil (2017), who reported a low relationship between perceived usefulness and behavioural intention. This suggests that in the context of Ghanaian Colleges of Education, perceived academic benefits alone are insufficient to strongly motivate Moodle adoption. Similarly, the weak influence of effort expectancy suggests that ease of use is not a major determinant of students' intentions. According to Venkatesh et al. (2003), effort expectancy influences behavioral intention, particularly during the early stages of technology adoption. The minimal effect observed in this study may indicate that students already possess adequate digital skills, reducing the importance of usability concerns. In contrast, social influence emerged as the strongest predictor of behavioral intention. This finding confirms the central role of social pressure and encouragement in shaping students' technology adoption decisions. Brata and Amalia (2018) emphasize that social support is a major driver of system usage, while Lin (2007) similarly found that social influence positively affects behavioural intention. The strong effect observed in this study suggests that lecturers, peers, and institutional authorities play a critical role in motivating students to use Moodle. The perception of Moodle as a "professional" and "trendy" learning platform may further enhance its social appeal.

Determinants of Use Behaviour

Behavioral intention significantly influenced use behaviour, confirming the UTAUT proposition that intention is a key predictor of actual system use (Venkatesh et al., 2003). This finding indicates that students who intend to use Moodle are more likely to engage with it consistently. Service quality also had a moderate-to-strong influence on use behaviour. This result highlights the importance of system efficiency, reliability, security, and responsiveness in promoting sustained usage. Rita et al. (2019) demonstrated that high e-service quality enhances user engagement, while Giandi et al. (2020) and Tarawneh et al. (2023) emphasized the link between intention and continued usage. Foltz et al. (2016) further confirmed that motivated users are more likely to translate intentions into consistent system use. The present findings support these studies and underscore the importance of maintaining high-quality LMS services. Facilitating conditions had a weak influence on use behavior, suggesting that institutional support and infrastructure function more as enabling factors than direct motivators. This finding is consistent with Venkatesh et al. (2003), who argued that facilitating conditions primarily influence usage indirectly. Neslin and Shankar (2009) and Bozan et al. (2016) similarly emphasized

that infrastructural support alone does not guarantee sustained system use. These results imply that although technical resources are necessary, their impact is often mediated by social and motivational factors.

The Dominance of Social Influence in a Mandatory Context

A significant finding of this study is that social influence emerged as the primary driver of Moodle LMS acceptance, carrying more weight than the perceived utility (performance expectancy) or ease of use (effort expectancy) of the system. This phenomenon can be attributed to the unique circumstances of "Emergency Remote Teaching" (ERT) during the COVID-19 pandemic. In the Ghanaian College of Education (CoE) context, the transition to online learning was not a voluntary consumer choice but a top-down institutional mandate. Students were essentially "pushed" into the digital environment where their choice of platform was dictated by their instructors and college leadership. Consequently, the subjective norm—the pressure felt from lecturers and peers to conform to the selected technology—became the deciding factor for adoption.

Furthermore, the influence of mentoring institutions played a pivotal role. Most Ghanaian CoEs are mentored by larger public universities that already utilize Moodle-based systems. As these mentoring institutions deployed their existing LMS infrastructures to their affiliate colleges, students and faculty felt a strong institutional and social obligation to adopt these specific platforms over competing applications like Google Classroom or Edmodo. In this environment, the "social pressure" to follow the institutional directive outweighed the individual student's assessment of whether the system was easy to use or directly improved their grades. This suggests that in developing educational contexts during crises, the "social collective" and institutional leadership are more powerful catalysts for technology adoption than the intrinsic qualities of the technology itself.

Model Robustness and Multicollinearity

The normality tests confirmed that the data met the assumptions required for parametric analysis, supporting the use of SEM and regression techniques. Additionally, the correlation analysis revealed no evidence of problematic multicollinearity among the independent variables. As noted by Hu et al. (2020), excessive correlations can compromise model validity and lead to unstable estimates. The absence of multicollinearity in this study indicates that each construct contributed uniquely to explaining students' acceptance of Moodle. This statistical robustness enhances the credibility of the findings and supports the reliability of the estimated relationships. The strong correlations observed among some constructs, such as performance expectancy, social influence, and service quality, suggest that these variables jointly shape students' perceptions of the LMS, while weaker correlations indicate independent effects.

Summary of Key Findings

Overall, the findings demonstrate that social influence, service quality, and behavioural intention are the most critical determinants of Moodle acceptance among Colleges of Education students in Ghana. While perceived usefulness and ease of use remain relevant, their influence is relatively weak in this context. Instead, social encouragement, institutional support, and system reliability play more prominent roles in shaping students' adoption and sustained use of the LMS. These results emphasize the need for Colleges of Education to strengthen institutional policies, promote lecturer engagement, enhance system quality, and provide continuous user support. Such strategies are essential for maximizing the educational benefits of Moodle and fostering effective digital learning environments.

CONCLUSION

The study explored the application of the Unified Theory of Acceptance and Use of Technology (UTAUT) model to measure the effect and quality of Moodle LMS usage among students in colleges of education in Ghana. The research sought to understand the influence of performance expectancy (PE), effort expectancy (EE), and social influence (SI) on students' behavioral intentions to use Moodle LMS, as well as the impact of facilitating conditions (FC), service quality (SQ), and behavioral intention (BI) on the actual use behavior of the students. The findings revealed that both performance expectancy and effort expectancy positively influenced students' behavioral intentions to use Moodle LMS, confirming that students are more likely to adopt the system when they perceive it as useful and easy to use. Furthermore, facilitating conditions and service quality, along with behavioral intention, positively influenced students' actual use behavior, indicating that when students have access to the necessary resources and perceive the system's services as high quality, they are more likely to engage with the LMS. Interestingly, social influence emerged as the most significant factor affecting behavioral intention, underscoring the importance of peer and instructor influence in motivating students to adopt Moodle LMS. This suggests that social factors, such as encouragement and recommendations from peers and instructors, play a crucial role in the acceptance and usage of educational technologies. Given these outcomes, the alternative hypothesis (H_1) is upheld, as the study demonstrated positive relationships between the independent variables (PE, EE, SI, FC, and SQ) and the dependent variables (BI and UB). These findings offer valuable insights for policymakers and educators in Ghanaian Colleges of Education, suggesting that improving social support, service quality, and resource availability can enhance Moodle LMS adoption and usage among students. Future initiatives should focus on addressing these key factors to foster a more effective and widespread integration of educational technologies within the colleges.

RECOMMENDATIONS

This study provides a number of suggestions for policy and practice. Despite the fact that social influence was found to be the strongest determinant of students' intention to use Moodle LMS, CoE eLearning campaigns should centre on strategies that leverage peer influence, instructor endorsements, and peer-driven support initiatives to increase adoption rates of LMSs. Secondly, given the moderate influence of service quality on use behavior, it is important for managers of eLearning programmes in colleges of education to continuously monitor and enhance the quality of Moodle LMS. This comprises ensuring system reliability, responsiveness, and user support. Regular feedback mechanisms should be implemented to tackle user concerns promptly and to make continual improvements. Although performance expectancy and effort expectancy showed weak influence on behavioral intention, these factors should not be ignored. Simplifying the user interface, providing comprehensive training, and demonstrating the substantial benefits of using Moodle can help boost these views and potentially increase user engagement. Facilitating conditions, which had a little impact on use behavior, should be enhanced by ensuring that the necessary infrastructure, technical support, and resources are always available to students and faculty. Management of colleges of education should assess and address any challenges to access and use of Moodle LMS to encourage more consistent usage.

FURTHER RESEARCH

The study emphasizes specific UTAUT variables (PE, EE, SI, FC, SQ, BI, and UB). Nevertheless, the UTAUT model includes other moderating factors such as age, gender, experience, and voluntariness of use that were not looked at in this work. These other variables might provide a more comprehensive understanding of Moodle LMS adoption. Future research could add factors like age, gender, experience, and voluntariness of use and examine their moderating effect on behavioural intentions and use behaviour of CoE students with regard to acceptance of Moodle LMS.

Limitations of the Study

This study is limited by its cross-sectional design, which captures participants' perceptions at a single point in time and restricts causal inference. The sample was drawn from selected colleges in specific regions of Ghana, which may limit the generalizability of the findings. Data relied on self-reported measures, which could be influenced by social desirability bias, and the study focused solely on students, omitting faculty or administrative perspectives. Future research could address these limitations through longitudinal designs, broader samples, and inclusion of additional stakeholders and contextual factors.

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Author Contributions: Daniel Paa Korsah conceptualized the study, designed the research framework, participated in data collection, supported the data analysis, interpreted the findings, and drafted the initial version of the full manuscript. He also supervised the research process and critically reviewed the manuscript at all stages. Justice Kwame Wireko-Ampem led the data analysis, contributed to the methodological design, participated in data collection, and drafted the methodology section. He also revised and refined the manuscript for intellectual content. Irene Forson conducted the literature review, participated in the data analysis, and provided critical revisions to enhance the scholarly quality, coherence, and publication readiness of the manuscript.

AI Statement: Artificial intelligence (AI) tools were used in this study to support language editing, formatting, and clarity of presentation. Specifically, AI-assisted tools were employed to improve grammar, coherence, and academic writing style. All substantive intellectual contributions, including the research design, data collection, analysis, interpretation of results, and conclusions, were carried out by the authors. The authors reviewed, verified, and validated all AI-assisted outputs to ensure accuracy, originality, and compliance with academic and ethical standards. The use of AI did not replace critical scholarly judgment, and full responsibility for the content of the manuscript rests with the authors.

Ethical Considerations: This study was conducted in accordance with established ethical standards for educational research. Participation in the study was entirely voluntary. All participants were adequately informed about the purpose, procedures, potential benefits, and possible risks associated with the research. They were also assured that their responses would be used solely for academic and research purposes. Informed consent was obtained from all participants before their inclusion in the study. Participants were assured of confidentiality and anonymity. No personally identifiable information was collected, and all responses were treated with strict confidentiality. Data were coded and stored securely, and access was restricted to the researchers only. The identities of participants and their respective institutions were not disclosed in any part of the report. Participants were informed of their right to withdraw from the study at any stage without any negative consequences. Measures were taken to ensure that no form of coercion, deception, or undue influence occurred during the data collection process. The researchers adhered to principles of honesty, integrity, and transparency in data collection, analysis, and reporting. All sources were appropriately acknowledged, and the findings were reported accurately without fabrication, falsification, or misrepresentation.

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Data Availability: The data that support the findings of this study are available from the corresponding author, Daniel Paa Korsah, upon reasonable request. The data are not publicly available due to privacy and ethical restrictions concerning the participants' information. Requests for requests will be reviewed to ensure compliance with ethical guidelines and protection of participant confidentiality.

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