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# Evaluating the effect of online learning model on students academic engagement and achievement in Ghana

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## Abstract

**Introduction/Background:** Higher education, especially internet education programmes, has changed a lot since online learning became popular so quickly. The University of Ghana has combined regional learning centres with its Learning Management System Sakai to help students do better in school and get more involved. However, not many real-world studies have looked at how online learning tools, tests, and contact sites affect how well students do in this setting. This research looks into how online learning evaluation, online learning tools, and communication platforms affect how well University of Ghana distance learners do in school and how engaged they are with their work.

**Materials and Methods**: A quantitative, survey-based, and cross-sectional research methodology was used for this work. Using Cochran's formula for an unknown population, a sample size of 385 students was found. Using a snowball sampling method, data were gathered online through Google Forms from students in different learning centres across Ghana. Out of the 344 acceptable replies, 89% were looked at. Academic success, student involvement, online learning systems, online learning evaluation, and online platforms and communication were all tested with validated tools that were based on earlier studies. For basic tests, SPSS was used to look at the data, and Smart-PLS was used for structural equation modeling to test the hypotheses.

**Results:** The results show that online learning assessment and online platforms and communication have a significant effect on academic achievement and engagement. The online learning method also positively affects academic success but has a weaker effect on student engagement. Structural Equation Modeling results supported the reliability and validity of the measurement constructs, with acceptable Cronbach's alpha values for all scales.

**Discussion:** The study supports the Self-Determination Theory, stressing that organised and well-designed online learning tests increase internal drive, leading to better academic success. Effective communication tools enable peer contact and teacher involvement, adding to better student engagement. However, difficulties such as internet connection and computer skills remain roadblocks to reaping the benefits of online learning.

**Conclusion:** The study supports the Self-Determination Theory, stating that planned and well-designed online learning tests boost internal drive, leading to better academic success. Effective communication tools allow friend touch and teacher participation, leading to better student engagement. However, problems such as internet access and computer skills remain roadblocks to getting the benefits of online learning.

**Keywords:** Online learning; Online learning system; Online learning assessment; Online platform and communication for learning; Student engagement; Academic achievement; Self-determination Theory

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## 1. Introduction

The outbreak of corona virus disease has increased the world's entire population's tension and anxiety without any discrimination (Nanjundeswaraswamy *et al.*, 2022). Many countries have imposed lockdown measures to reduce social contact and to contain the spread of the Novel Coronavirus (Clark *et al.*, 2021). Covid-19 is a global pandemic caused by the SARS-CoV-2 coronavirus that has implemented lockdowns in several countries around the world (Yaseen *et al.*, 2021). With the advent of COVID-19 pandemic and the shutdown of universities worldwide for fear of contamination due to the spread of the coronavirus, higher educational institutions have deemed necessary to adopt new teaching strategies, exclusively online, to deliver their curriculum content and keep from the Corona virus widespread at bay (Khaled and Amorri, 2023).

Similarly, the fast expansion of Information and Communication Technologies ICT, internet technologies, and web-based applications has prompted an unprecedented revolution in universities globally (Madhushree et al., 2020; Gupta and Jain, 2017). These technical breakthroughs have transformed higher education by promoting the emergence of electronic learning e-learning, which is altering conventional teaching and learning techniques on university campuses (Ukpe, 2023). E-learning allows students and instructors to access digital materials, engage in virtual collaboration, and participate in interactive learning experiences, breaking geographical boundaries and enabling more flexibility in education (Lazarenko and Hapchuk, 2024; Singh et al., 2024).

Universities in Ghana have not been left behind in embracing online learning to increase educational accessibility and flexibility (Demuyakor, 2021; Addae et al., 2022). The University of Ghana, as a major institution in the nation, has embraced digital transformation via its Online Distance Learning ODL programs, which give students with the chance to pursue higher education without the limits of physical presence (Mahama et al., 2024). These programs employ virtual learning environments, digital course materials, and interactive platforms to enable successful teaching and learning. Through the deployment of Learning Management Systems LMS, video conferencing technologies, and e-resources, the institution has increased its reach to students across diverse areas, ensuring that education stays accessible and adaptive to current needs (Bossman and Agyei, 2022). The combination of asynchronous and synchronous learning modalities further helps students to manage their studies with job and personal responsibilities, making higher education more accessible, especially for non-traditional learners (Jung, et al., 2023). This trend towards online learning at Ghanaian institutions reflects a larger commitment to using technology for academic excellence and lifelong learning in an increasingly digital society (Harle et al., 2021).

Despite the tremendous advances in integrating e-learning into higher education institutions internationally, poor countries—particularly in Africa—have suffered a slower adoption rate compared to their Western counterparts (Akpan et al., 2024). Several issues, including poor technical infrastructure, restricted internet access, high implementation costs, and aversion to change, have contributed to this discrepancy (Barikzai et al., 2024). However, in the last decade, several African colleges have acknowledged the vital role of e-learning in boosting educational accessibility and quality. As a consequence, university administrators have undertaken intentional and purposeful efforts to adopt e-learning programs, modernise digital infrastructures, and educate staff and students in the usage of online learning platforms (Kibuku et al., 2020). These initiatives attempt to bridge the digital divide and guarantee that institutions in underdeveloped countries can compete with and interact successfully with their counterparts in rich nations, thereby enhancing educational performance and extending learning possibilities.

Online learning often referred to as E-learning or remote learning is basically a web-based program that enables learners access to knowledge or information whenever required, independent of their proximity to a place or time limitations (Akpen et al., 2023). Online education encourages a student-centered learning method, stressing active involvement, self-directed learning, and interaction with digital information (Juty, 2024). Unlike conventional teacher-led education, online learning enables students to take more responsibility for their academic development by researching resources, communicating with classmates, and participating in interactive activities (Huddar, Chavarkar and Patil, 2023). A broad variety of digital tools and technology enable this approach, including computers, mobile devices, high-speed internet, virtual learning environments, and multimedia materials (Akpen et al., 2023). These technologies allow students to access instructional information anytime and anywhere, engage in live or asynchronous conversations, and employ e-learning platforms that combine videos, simulations, gamified learning, and real-time feedback (Khaled and Amorri, 2023).

Additionally, online education enables individualised learning paths, enabling students to study at their own speed and revisit subjects as required (Yaseen et al., 2021). Through digital collaboration tools such as discussion boards, video conferencing, and shared documents, students may participate in meaningful academic debates, get help from teachers, and improve their overall learning experience (Alghzaly, 2024). By combining interactive technology and supporting

flexible, self-paced learning, online education delivers an inclusive and dynamic learning environment that accommodates to varied learning preferences and increases information retention (Muhammad et al., 2021).

Although various research e.g., Juty, 2024; Akpen et al., 2023; Kuh et al., 2020; Yaseen et al., 2021; Banda et al., 2021 have studied the influence of online learning on students' academic performance, most have relied on general metrics to evaluate online learning. However, this research adopts a more complex approach by assessing online learning via three unique dimensions—Online Learning System OLS, Online Learning Assessment OLA, and Online Platform and Communication for Learning OPCL. By doing so, it intends to give a greater understanding of how these variables impact student academic progress and engagement at the University of Ghana, Legon.

### 1.1. Statement of Problem

The rising popularity of online learning in higher education has revolutionised conventional teaching approaches, notably in distant education programs (Kibuku et al., 2020). While the University of Ghana has incorporated online learning via the Sakai Learning Management System and regional learning centers, the impact of these platforms in boosting student academic success and participation remains uncertain. Existing research indicates the potential of online learning assessments, digital communication platforms, and learning systems in enhancing educational results, although empirical studies unique to the Ghanaian setting are sparse. Additionally, problems such as internet connection concerns, students' digital competence, and participation discrepancies may hamper the efficiency of online learning. Therefore, this study attempts to explore the influence of online learning assessment, online learning systems, and online platform communication on student academic success and engagement among distance learners at the University of Ghana, filling a key gap in research and practice.

### *Aim and Objectives of the Study*

The aim of this study is to examine the effect of online learning model on student engagement and achievement in Ghana. The specific Objectives are to:

- Explore the effect of online learning system on student academic achievement of in Ghana.
- Investigate the effect of online learning assessment on student academic achievement in Ghana.
- Determine the impact of online platform and communication for learning on student academic achievement in Ghana.
- Analyse the influence of online learning system on student engagement in Ghana.
- Examine the effect of online learning assessment on student engagement in Ghana.
- Explore the influence of online platform and communication for learning on student engagement in Ghana

## 2. Review of Extant Literature

This section review literature on student academic achievement, student engagement, online learning, empirical review and theoretical framework.

### 2.1. Concept of Student Academic Achievement

Academic achievement has been described in different recent academic works. Ojeleye, Abu-Abdissamad, et al. (2022), described it as the measured success of students based on exams, homework, and general academic growth. According to Ojeleye, Kaura, et al., (2022), it represents a student's success in meeting educational standards, often measured through grades, standardized tests, and cognitive skill development. Jacob et al. (2020), described it as the achievement of learning goals proven through evaluations, knowledge application, and skill gain. Estévez et al. (2021), viewed it as the result of cognitive involvement, drive, and self-regulated learning techniques that add to academic achievement. Fokkens-Bruinsma et al. (2021), stressed its complex nature, covering intellectual growth, critical thought, and understanding of topic material. Anthonysamy et al. 2020, stressed the role of learning settings, teaching quality, and personal effort in creating academic success. Finally, Yan (2020), described it as the total result of academic work, social factors, and educational chances that affect student success. These definitions, academic achievement is a multidimensional construct that describes the capacity of students to meet educational goals through intellectual participation, inspiration, instructional quality, and external support, usually measured by assessments, grades, and the acquisition of knowledge and skills.

### 2.2. Concept of Student Engagement

Student engagement has been described in different modern research works. Wong et al. (2020), described it as a complex concept covering behavioral, social, and cognitive participation in learning tasks. According to Raza et al. (2020), it reflects the degree of students' active involvement, drive, and interest in their learning experiences. Amerstorfer and Freiin von Münster-Kistner (2021), described it as a dynamic process affected by teaching methods, peer relationships, and institutional support, leading to useful learning results. Wong and Liem (2022), viewed student engagement as the amount to which students show effort, determination, and passion toward their studies. Reeve et al. (2025), stressed its psychological side, tying involvement to self-determination, internal drive, and agency in learning. Trowler et al. (2022), described it as the matching of students' academic actions, feelings, and reasoning with administrative standards and learning goals. Finally, Nelson et al. (2024), stressed the role of personal, social, and environmental factors in creating involvement levels. Synthesizing these definitions, student engagement is a multidimensional and dynamic process encompassing psychological participation, emotional investment, and intellectual involvement in learning, influenced by motivation, instructional strategies, interactions with others, and institutional support that improves academic success.

### 2.3. Concept of Online Learning Model

Online learning mode has been described in different recent academic works Khaled and Amorri, (2023). Samara et al. (2023), described it as a digitally mediated teaching method that supports learning through the internet, providing for freedom in time and place. According to Banda et al. (2021), it is an organised and purposeful method of education provided through digital media, separate from emergency remote teaching. Nanjundeswaraswamy et al. (2022), described online learning as an educational system utilising digital tools to build engaging, self-paced, and student-centered learning experiences. Kafumukache et al. (2023), viewed it as an educational model that combines digital material, virtual teamwork, and evaluation tools to improve accessibility and participation. Singh and Thurman (2019), stressed its delayed and synchronous components, allowing both real-time and self-directed learning. Means and Neisler (2021), noted its dependence on Learning Management Systems LMS and multimedia tools to support organised academic involvement. Lastly, Zekaj (2023), described online learning as a technology-driven method of education that promotes liberty and individual learning paths for students. Ultimately, these definitions, viewed online learning mode as a structured, technology-enhanced approach that facilitates education through digital platforms, integrating synchronous and asynchronous elements to support student engagement, flexibility, and accessibility while leveraging various digital tools and pedagogical strategies to optimize learning outcomes.

The Online Learning Model out of eight variables as described Nanjundeswaraswamy et al. (2022), due to their practicability and parsimony in the study context. The include: Online Learning System OLS, Online Learning Assessment OLA, and Online Platform and Communication for Learning OPCL. The internet Learning System OLS is the system that powers internet schooling. Abuhassna et al. (2020), described it as digital tools that help offer classes and handle learning. Alismaiel (2021), described it as web-based tools that improve teaching and engagement, while Villegas-Ch et al. (2020), see it as a system that responds to students' needs using artificial intelligence. The Online Learning Assessment OLA refers to how students are tested and graded online. Lee and Tan (2022), explain it as using quizzes and e-portfolios for progress tracking. Nanjundeswaraswamy et al. (2022), noted that both current and final reviews are done online, and Ahmad et al. (2023), add that AI helps provide real-time feedback. The Online Platform and Communication for Learning OPCL focuses on how students and teachers communicate online. Park and Kim (2022), discuss tools like groups and video calls for participation. Garcia and Lopez (2023), emphasize group talks and chat features, while Thompson et al. (2023), described it as a mix of live and recording conversation for better learning.

In sum, the Online Learning System OLS refers to the technology infrastructure and tools that enable the delivery of educational material and control of learning activities in a virtual setting. Online Learning Assessment OLA covers the methods and tools used to analyse and measure students' learning growth and success in an online setting. Online Platform and Communication for Learning OPCL involves the digital platforms and communication methods that support contact and teamwork among students and teachers in the online learning process. In the study setting, the Online Learning Model works through three key areas: OLS offers the technology for learning, OLA ensures students are tested successfully, and OPCL helps students and teachers interact. These factors support student involvement and success, making online education more engaging and efficient.

### 2.4. Empirical Review

The reviewed works collectively show the impact of online learning on student achievement and engagement, revealing both benefits and difficulties across different settings. Yaseen et al. (2021), found that while Jordan and the UK share similar technological powers, students in both countries faced challenges such as communication hurdles, access to

hardware, and absence, though taped classes and extended teacher access were helpful. Similarly, Banda et al. (2021), and Kafumukache et al. (2023), found a positive effect of e-learning on student achievement, with Banda et al. (2021) showing its effectiveness through a quasi-experimental study, while Kafumukache et al. (2023) noted its high cost as a limitation. Huddar et al. (2023), performed a meta-analysis and found that online education modestly impacts academic success, showing its usefulness varies by situation. Juty (2024), proved a good impact of e-learning on rural students in Bangladesh, stressing its role in improving access to education. Akpen et al. (2023), in an in-depth investigation, found that online learning improves academic success due to its freedom and accessibility, allowing students to learn at their own pace. Finally, Clark et al. (2021), stressed that online learning greatly affected student success during the COVID-19 outbreak, further supporting its usefulness in crisis situations. Overall, while online learning has been shown to improve academic achievement and engagement, issues such as accessibility, technical limits, and student participation remain important areas for further study and policy development. Therefore, the study hypothesised that:

- ***H1a:*** Online learning system has significant effect on student academic achievement of in Ghana.
- ***H1b:*** Online learning assessment has significant effect on student academic achievement in Ghana.
- ***H1c:*** Online platform and communication for learning has significant effect on student academic achievement in Ghana.
- ***H2a:*** Online learning system has significant effect on student engagement in Ghana.
- ***H2b:*** Online learning assessment has significant effect on student engagement in Ghana.
- ***H2c:*** Online platform and communication for learning has significant effect on student engagement in Ghana

### 2.5. Self-Determination Theory

The study is based on self-determination theory. Self-Determination Theory SDT, created by Deci and Ryan 1985, 2000. it is a psychology theory that explains human drive, particularly in learning settings (Deci and Ryan, 2012). It believes that individuals are led by internal and external impulses, with optimal learning happening when three basic psychological needs are satisfied: liberty, competence, and relatedness (Vansteenkiste et al., 2006). Autonomy refers to the ability of learners to control their educational situations, making choices that fit with their hobbies and learning goals (Deci and Ryan, 2000). Competence refers to the need for students to feel successful and capable in their learning tasks, which is improved by organised feedback and chances for mastery (McMillan and Hearn, 2008). Relatedness emphasizes the value of social interactions and meaningful relationships with teachers and peers, which create a sense of belonging and support (Deci and Ryan, 2000). These three factors jointly add to student engagement, drive, and academic success.

In the context of online learning, SDT is particularly important as digital tools can either support or hinder these psychological needs. For instance, well-designed online learning settings that provide engaging material, adaptable feedback, and chances for teamwork improve students' sense of skill and relatedness, thereby increasing involvement. Additionally, the freedom of online learning supports liberty by allowing students to control the pace and framework of their learning experiences. However, badly planned online classes missing interactive aspects and teacher contact may lead to disengagement, decreased drive, and lower success. Thus, SDT serves as a useful tool for analysing the success of online learning models, stressing the need for educational strategies that promote innate drive and psychological well-being.

## 3. Methodology of Data Collection

The study is quantitative applying both survey and cross-sectional research methods. A survey study method includes carefully taking data from a group of people using organised tools such as questions or interviews (Ojeleye, Umar, et al., 2022). It is frequently used to gather information on views, opinions, habits, or traits of a group Sekaran and Bougie (2016). A cross-sectional research method is a type of observational study that analyzes data from a community at a single point in time (Ojeleye, Kareem, et al., 2022). It is used to find trends, relationships, or differences among factors without changing them, making it useful for descriptive and correlational studies (Creswell and Creswell, 2018). The population of the study is the total number of distant learning students of the University of Ghana. The university has built Learning Centres across different areas, including Accra, Bolgatanga, Cape Coast, Koforidua, Kumasi, Sekondi-Takoradi, Sunyani, Tamale, Tsito, and Wa. These places provide regular face-to-face meetings on weekends to support online learning. The university uses the Sakai Learning Management System LMS to support online learning. This site allows students to view course materials, submit tasks, and engage in conversations. Hence, since the total number of these students across different areas is unknown. As a result, the study applied Cochran's sample size method for an infinite/unknown population as suggested by Ojeleye and Mustapha (2024). Based on this formula a sample size of 385 was derived and the 385 pieces of the questionnaire were distributed digitally using Google online questionnaire to the students of the Accra, Bolgatanga, Cape Coast, Koforidua, Kumasi, Sekondi-Takoradi, Sunyani, Tamale, Tsito, and Wa

using snowball sample technique within 2 months. The snowball sampling method uses a recommendation process to reach specific respondents was applied. Meanwhile, out of the 385 pieces of questionnaire given, 344 89% were finished and used for the data analysis.

Validated instruments from previous studies were adapted and utilised for the study using a 5-point Likert scale 1= strongly disagree and 5= strongly agree. Academic Achievement was measured using 5-item Student Academic Achievement scale of Samara et al. (2023), with reported Cronbach's alpha of 0.812 showing that the instrument is appropriate for the study owing to its consistency. Sample of item is "I can think more creatively after taking online courses". Student Engagement was measured using 7-item Student Engagement Scale of Samara et al. (2023) with reported Cronbach's alpha of 0.851 showing its instrument reliability. Sample of item is "I can show off my abilities by engaging in online learning". Online Learning was measure using multi-dimensional online learning scale of Nanjundeswaraswamy et al., (2022). Online Learning System OLS consist of 3-items with reported Cronbach's alpha of 0.842. Sample of item is "I am comfortable with the speed of the Internet while accessing online classes". Online Learning Assessment OLA was measured using 3-item with reported Cronbach's alpha of 0.834. Sample of item is "The Assessment criteria for online learning gives me a positivity towards fair results" Lastly, Online Platform and Communication for Learning OPCL was measured using 3-item. Sample of item is "The online platforms make it easier to interact with other students" with reported Cronbach's alpha of 0.877.

### 3.1. Data Analysis and Presentation

Data were analysed using Statistical Software for Social Sciences SPSS for preliminary analyses such as detection of outliers, multicollinearity, normality and common method bias tests were performed on the data collected. Structural Equation Model particularly, Smart-PLS was employed to test construct outer loading, reliability, validity, coefficient of determination $R^2$, and the hypothesised relationships using structural and measurement models.

### 3.2. Evaluation of Measurement Model

Measurement model was applied to measure first the outer loading. Hair et al. (2022), suggested keeping loadings of 0.7 and above. However, due to the chance of having loadings of less than 0.70 in social science research, they supported keeping loadings between 0.4 to 0.7 based on the effect of these loadings range on construct reliability and average variance extracted (AVE). Contrarily, Hulland (1999) and Ojeleye and Ojeleye (2024), advised the preservation of loads of ≥0.5. As such, this study removed outer loadings of <0.5 limits. Based on this suggestion loadings SE and SE6 were deleted due to loadings <0.5 See: Figure 1 and Table 1. Furthermore, the constructs' reliability was tested using composite reliability and Cronbach's alpha. Hair et al. (2017), suggested a level of ≥0.7 to show that the concept reliability is promised and the tool of the study is consistent and suitable. Table 1 below shows that the values of combined reliability and Cronbach's alpha ratings are all greater than 0.70. Hence, the designs of the study are solid. In addition, convergent validity was tested using average variance extracted AVE. Fornell and Larcker (1981), proposed that for a construct to have convergent validity, the number of AVE must not be <0.5. As shown in Table 1 below, the AVE values are all >0.5 showing that convergent validity is proven.

Meanwhile, the coefficient of determination $R^2$ depicted in Figure 1 above and Table 3 below is 0.544 (54.4%) and 0.481 (48.1%) for Model 1 and Model 2 respectively. In model 1 it shows that 54.4% variation in student academic achievement is explain by the independent variables i.e., PLA, OLS and OPCL while the remaining 55.6% is attributed to other variables not included in the model. Similarly, in Model 2 48.1% variance in student engagement is connected to the independent variables OLA, OLS and OPCL. While the remaining 51.9% attributed to other constructs not included in the model. According to Cohen (1988), the $R^2$ explanatory power for Model 1 and Model 2 can be considered moderate

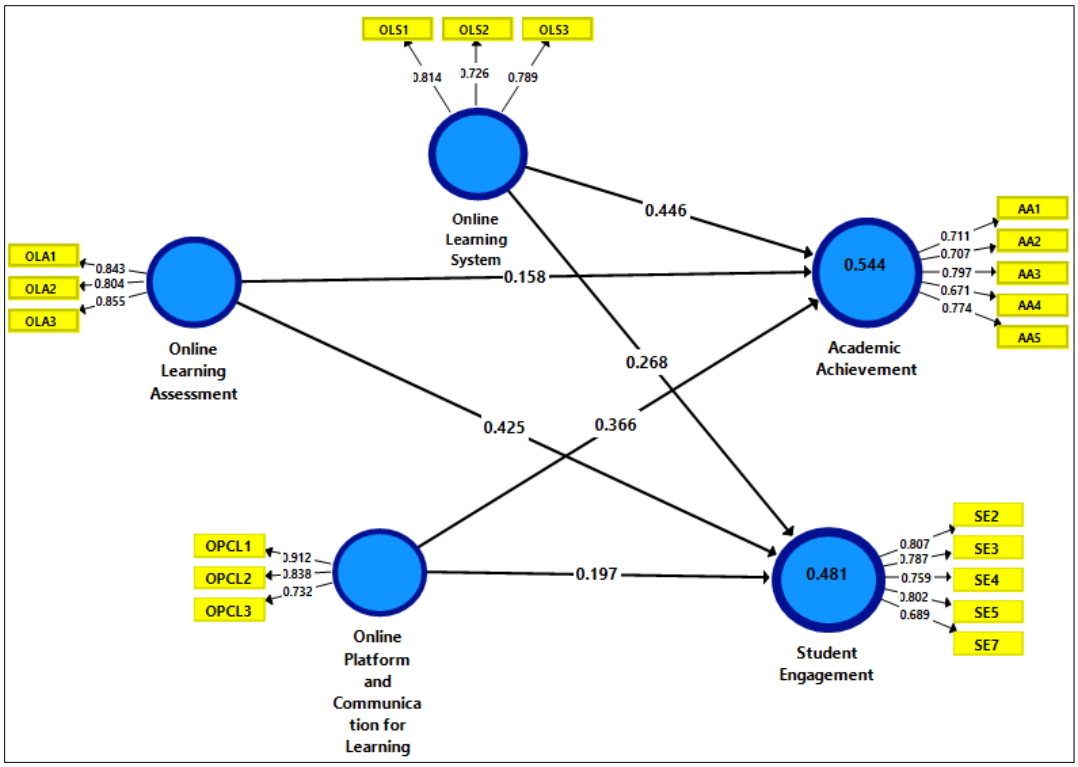


**Figure 1** Measurement model

**Table 1** Outer loadings, Reliability and Convergent Validity

| Constructs | Indicators | Outer loadings | Cronbach's alpha | Composite Reliability | AVE | Decision |
|---|---|---|---|---|---|---|
| Academic Achievement | AA1 | 0.711 | 0.785 | 0.853 | 0.538 | Accepted |
| | AA2 | 0.707 | | | | |
| | AA3 | 0.797 | | | | |
| | AA4 | 0.671 | | | | |
| | AA5 | 0.774 | | | | |
| Online Learning Assessment | OLA1 | 0.843 | 0.783 | 0.873 | 0.697 | Accepted |
| | OLA2 | 0.804 | | | | |
| | OLA3 | 0.855 | | | | |
| Online Learning System | OLS1 | 0.814 | 0.673 | 0.820 | 0.604 | Accepted |
| | OLS2 | 0.726 | | | | |
| | OLS3 | 0.789 | | | | |
| Online Platform and Communication for Learning | OPCL1 | 0.912 | 0.778 | 0.868 | 0.689 | Accepted |
| | OPCL2 | 0.838 | | | | |
| | OPCL3 | 0.732 | | | | |
| Student Engagement | SE2 | 0.807 | 0.827 | 0.879 | 0.593 | Accepted |
| | SE3 | 0.787 | | | | |
| | SE4 | 0.759 | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | SE5 | 0.802 | | | | |
| | SE7 | 0.689 | | | | |

Additionally, discriminant validity was evaluated using the Heterotrait-Monotrait HTMT ratio of correlation. Since the constructs are conceptually different HTMT 0.85 threshold as recommended by Kline (2011), was employed as against HTMT 0.9 recommended by Henseler et al. (2015), for conceptually similar constructs. Table 2 below shows that the values are all less than the 0.85 threshold. Thus, discriminant validity is confirmed.

**Table 2** Discriminant validity using HTMT correlations

| Construct | Academic Achievement | Online Learning Assessment | Online Learning System | Online Platform and Communication for Learning | Student Engagement |
|---|---|---|---|---|---|
| Academic Achievement | | | | | |
| Online Learning Assessment | 0.614 | | | | |
| Online Learning System | 0.834 | 0.813 | | | |
| Online Platform and Communication for Learning | 0.610 | 0.219 | 0.322 | | |
| Student Engagement | 0.608 | 0.755 | 0.753 | 0.412 | |

### 3.3. Evaluation of Structural Model

The structural model was used to evaluate the hypothesized relationship

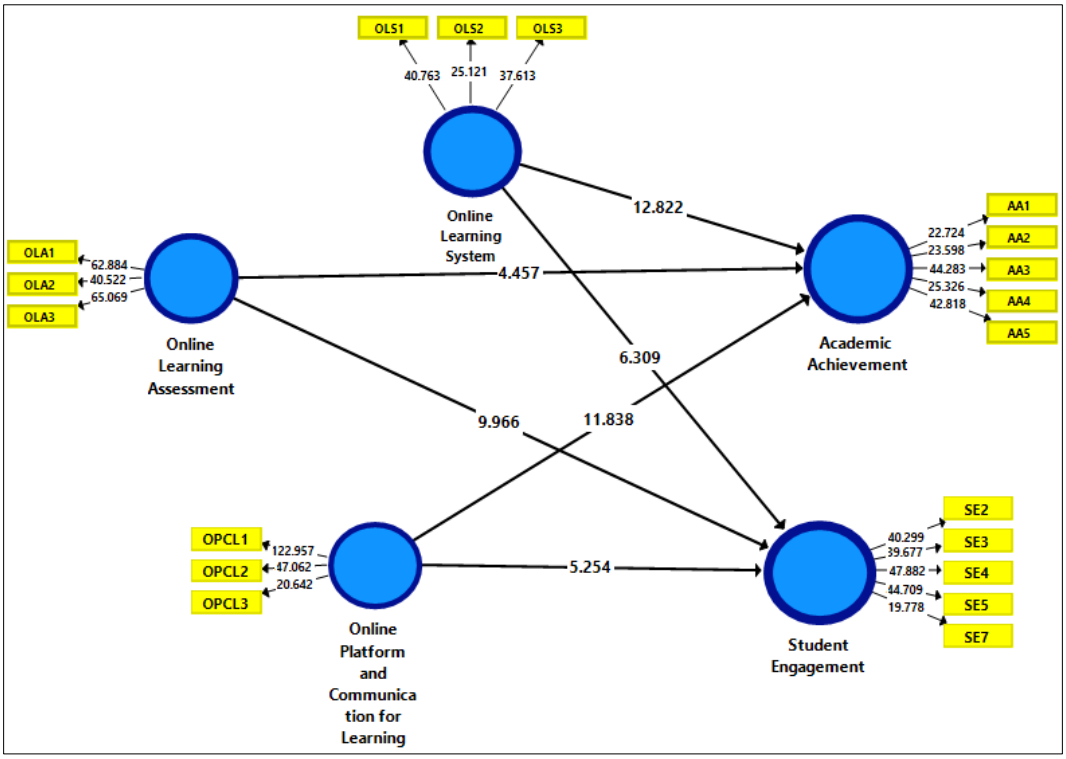


**Figure 2** Structural Model

**Table 3** Hypothesized Relationship

| Hypotheses | **Relationship** | **Beta** | **Standard Deviation** | **T Statistics** | **P Values** | **Decision** |
|---|---|---|---|---|---|---|
| HL1a | Online Learning System -> Academic Achievement | 0.446 | 0.035 | 12.822 | 0.000 | Supported |
| HL1b | Online Learning Assessment -> Academic Achievement | 0.158 | 0.036 | 4.457 | 0.000 | Supported |
| HL1c | Online Platform and Communication for Learning -> Academic Achievement | 0.366 | 0.031 | 11.838 | 0.000 | Supported |
| HL2a | Online Learning System -> Student Engagement | 0.268 | 0.043 | 6.309 | 0.000 | Supported |
| HL2b | Online Learning Assessment -> Student Engagement | 0.425 | 0.043 | 9.966 | 0.000 | Supported |
| HL2c | Online Platform and Communication for Learning -> Student Engagement | 0.197 | 0.038 | 5.254 | 0.000 | Supported |
| | Model 1: $Q^2 = 0.272$ | | Model 2: $Q^2 = 0.261$ | | | |

The data from Table 3 show strong factual support for the predicted links between online learning aspects and academic achievement for students as well as involvement. The results show that the Online Learning System OLS significantly affects academic achievement (β = 0.446, p = 0.000), suggesting that an efficient digital learning system improves students' ability to understand and apply knowledge. Similarly, Online Platform and Communication for Learning OPCL has a significant effect on academic achievement (β = 0.366, p = 0.000), showing the value of engaging tools in encouraging learning results. While Online Learning Assessment OLA also has a positive effect (β = 0.158, p = 0.000), its relatively lower beta value suggests that although assessment strategies contribute to academic success, their effectiveness is likely amplified when combined with a well-structured learning system and communication platforms. The predicted accuracy of the model for academic success is further supported by $Q^2$ = 0.272, showing a significant percentage of variation explained by the online learning factors.

Similarly, the results support the role of online learning components in improving student involvement. Online Learning assessment OLA shows the biggest effect on engagement (β = 0.425, p = 0.000), emphasizing the importance of well-structured evaluation methods in encouraging engagement. Online Learning System OLS also significantly affects involvement (β = 0.268, p = 0.000), showing that an efficient digital platform supports drive and involved learning. Meanwhile, Online Platform and Communication for Learning OPCL positively affects engagement (β = 0.197, p = 0.000), although its effect is smaller compared to the other factors. The model's prediction accuracy for engagement $Q^2$ = 0.261 shows that these factors combined add meaningfully to student participation in online learning. These results underscore the necessity of combining dynamic tests, controlled learning settings, and engaging communication tools to create a complete online education experience that supports both academic success and active engagement.

## 4. Discussion

The results of the study showed that the Online Learning System OLS has a major effect on the academic achievement of students. This shows that the speed, portability, and usefulness of online learning tools play a crucial role in shaping students' academic success (Song et al., 2024). A well-structured OLS provides students with smooth access to learning materials, engaging tools, and evaluations, allowing them to connect effectively with their schoolwork. Additionally, the freedom of online learning tools allows students to learn at their own pace, which can lead to improved understanding and better academic results. However, obstacles such as bad internet connection, technical problems, and inadequate digital skills may limit the full benefits of OLS. These results agree with earlier studies (e.g., Juty, 2024; Yaseen et al., 2021) that show the importance of a strong online learning system in improving academic success. Therefore, improving the usefulness and usability of online learning tools can further support students' academic success.

The study's results showed that Online Learning Assessment OLA has a major effect on student academic achievement. This suggests that well-structured and fair assessment methods in online learning settings increase students' academic success by providing clear standards, quick feedback, and chances for self-improvement (Tatineni, 2020). Effective

online tests, such as quizzes, tasks, and live evaluations, help students rate their knowledge, find areas for improvement, and strengthen learning outcomes. Additionally, constant and informal exams in online platforms can boost students' drive and interest, leading to better academic results (Vashishth et al., 2024). However, difficulties such as technical issues, worries over academic ethics, and possible flaws in automatic marking systems may affect the trustworthiness of online exams. These results are aligned with previous studies e.g., (Akpen et al., 2023; Banda et al., 2021), which stress that open and well-designed online exams add greatly to student learning and academic success. Thus, improving the trustworthiness, fairness, and efficiency of online exams can further improve student success.

The study's results showed that Online Platform and Communication for Learning OPCL has a significant effect on student academic achievement. This suggests that engaging and user-friendly online platforms improve students' ability to access learning materials, connect with teachers, and work with peers, eventually improving their academic performance (Suhadi and Mustaffa, 2023). Effective communication tools, such as discussion boards, live talks, and video calling, enable real-time interactions and provide students with fast feedback, explanation of ideas, and peer support (Adeoye and Akinnubi, 2023). Additionally, well-structured online platforms ensure smooth content delivery and reduce learning delays, allowing students to stay engaged and focused. However, obstacles such as bad internet connection, lack of digital knowledge, and limited teacher response may hinder the usefulness of online communication tools. The results agree with earlier studies (e.g., Yaseen et al., 2021; Banda et al., 2021), which show the importance of interactive online tools in creating a favourable learning atmosphere. Therefore, improving the ease, usefulness, and communication features of online learning tools can greatly add to student academic success.

The study's results showed that the Online Learning System OLS has a significant effect on student engagement, stressing the important role of technology-driven learning tools in encouraging active participation. A well-structured and user-friendly online learning system improves students' ability to access course materials smoothly, connect with digital tools, and participate in joint learning activities (Sun and Shen, 2016). Features such as video material, engaging tests, real-time conversations, and gamified aspects help maintain students' interest and drive. Moreover, a reliable and efficient system reduces technical difficulties that could otherwise disrupt learning, thereby encouraging students to stay involved (Yang and Singh, 2024). These results are aligned with previous study (e.g., Kuh et al., 2020; Yaseen et al., 2021), which shows that a successful online learning system promotes self-directed learning, knowledge retention, and useful student interaction. However, obstacles such as poor digital infrastructure, slow internet connection, and a lack of technology help may limit participation levels. To maximize student engagement, colleges should continuously improve their learning management systems, ensuring they are simple, quick, and equipped with engaging features that enhance the learning experience.

The study's results suggest that Online Learning evaluation OLA has a significant effect on student engagement, highlighting the crucial role of open, clear, and engaging evaluation methods in supporting active participation. Effective online exams, such as quizzes, tasks, peer reviews, and real-time feedback, urge students to stay engaged in their learning process (Kearns, 2012). When students view exams as well-structured, important, and matched with learning goals, they are more likely to engage closely with course material (Cavinato et al., 2021). Additionally, quick comments from teachers helps students track their progress, find areas for improvement, and stay encouraged. These results agree with previous research (e.g., Banda et al., 2021; Yaseen et al., 2021), which shows that testing design significantly impacts students' learning habits and interest levels. However, challenges such as confusing scoring standards, lack of teacher comments, and worries over academic ethics in online exams may lower participation (Kearns, 2012). To improve student participation, colleges should adopt varied, engaging, and technology-driven evaluation methods that support ongoing learning and active engagement.

The study's results show that Online Platform and Communication for Learning OPCL greatly impact student engagement, stressing the importance of engaging digital tools in encouraging active participation. Effective online communication platforms, such as discussion boards, live talks, and joint tools, create an engaging learning atmosphere where students can connect with teachers and peers in real time (Onyema et al., 2019). When students have access to smooth communication channels, they are more likely to join in talks, seek answers, and work on academic projects, which improves their overall learning experience (Vlachopoulos and Makri, 2019). These results agree with previous studies (e.g., Yaseen et al., 2021; Banda et al., 2021), which show that digital platforms play a key role in promoting student enthusiasm and interest in online learning. However, factors such as poor internet connection, delayed teacher replies, and limited technical skills can prevent effective communication and lower participation. To improve student involvement, schools should invest in user-friendly, well-integrated learning management systems with engaging features that promote teamwork, quick feedback, and a sense of community among learners.

### 4.1. Implications

The results of this study have important real effects for educational institutions, especially those offering online learning programs. The positive effect of the Online Learning System OLS, Online Learning Assessment OLA, and Online Platform and Communication for Learning OPCL on student academic achievement and engagement highlights the need for universities to invest in robust digital infrastructure, effective assessment strategies, and interactive communication tools. Institutions should focus on improving internet accessibility, enhancing learning management systems, and adding more interesting digital tools such as AI-driven evaluations and live discussion platforms. Additionally, lawmakers and educators should favour student-centered online learning approaches by adding flexible assessment methods, quick feedback mechanisms, and personalized learning paths to cater to diverse student needs. By handling these aspects, colleges can create a more engaging and highly stimulating online learning setting, thereby improving student results and retention rates.

The results agree with the Self-Determination Theory SDT, which stresses that people are more driven to learn when their basic psychological needs—autonomy, competence, and relatedness—are met. The study shows that a successful Online Learning System OLS improves students' sense of ability by providing them with available learning tools and well-structured classes. Similarly, a well-designed Online Learning Assessment OLA promotes liberty by allowing students to take control of their learning progress through open and clear reviews. Additionally, the role of Online Platform and Communication for Learning OPCL in improving involvement supports the relatedness aspect of SDT, as students feel more linked to their instructors and fellow students through engaging online talks and joint activities. These results support the theoretical view that well-structured online learning settings can promote innate drive, leading to better academic achievement and interest.

## 5. Conclusion and Recommendations

The study shows the significant effect of online learning models—comprising online learning systems, online learning exams, and online sites for communication—on student involvement and academic success. The results show that well-structured digital learning settings increase student desire, participation, and success by giving freedom, engaging material, and real-time feedback. However, obstacles such as digital knowledge gaps, internet usability problems, and participation differences must be handled to reap the benefits of online learning. Grounded in Self-Determination Theory SDT, the study emphasizes the need for online education models that promote agency, competence, and relatedness, ensuring a more inclusive, engaging, and effective learning experience.

Based on the results of the study, the following recommendations are proposed:

- The University of Ghana should improve the security and usability of its Online Learning System OLS by improving internet facilities and providing smooth access to learning materials. This will help students connect successfully with course material, thereby improving their academic achievement.
- The school should adopt open, clear, and adaptable online testing methods that provide prompt feedback to students. Incorporating AI-driven assessment tools and diverse review methods can ensure more accurate and thorough tracking of student learning results.
- The university should improve its Learning Management System LMS by adding more engaging features such as virtual study groups, peer conversation boards, and real-time teacher comments. This will promote cooperation, improve information flow, and directly affect student academic success.
- To increase student involvement, the university should implement gaming elements, multimedia-based educational material, and adaptable learning tools within its online learning system. These engaging features will support student attention and encourage active participation in learning activities.
- Online assessment methods should be built to encourage student involvement by adding self-assessment tools, group reviews, and formative tests. This will ensure that students are constantly involved in their learning process and driven to perform well.
- The university should provide organised contact routes within its online platforms, ensuring that students have real-time access to teachers and academic support services. Regular virtual office hours, automatic response systems, and discussion boards can improve engagement and contact among students and teachers.

By following these suggestions, the University of Ghana can improve the efficiency of its online learning system, evaluation methods, and communication tools, eventually improving both student academic achievement and engagement.

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