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Students' readiness for E-learning and their satisfaction: The mediating role of self-regulation skills of students among universities in Ghana

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Abstract

E-learning offers distinct challenges and opportunities for students and educators alike. This study investigated the effect of students' e-learning readiness on their satisfaction, along with the mediation effect of self-regulation skills in that relationship, among postgraduate students at selected Ghanaian universities. Drawing on social presence theory, the research focused on three institutions offering distance education programmes: the University of Ghana, the University of Cape Coast, and the Kwame Nkrumah University of Science and Technology. Data were gathered via questionnaires from 500 respondents. This study employed the disjoint two-stage approach within the reflective-reflective hierarchical component model. The findings revealed that e-learning readiness positively and significantly influences student satisfaction and self-regulation skills. Self-regulation skills, in turn, positively and significantly affect satisfaction. Moreover, self-regulation skills exert a statistically significant positive mediating effect between e-learning readiness and satisfaction. To leverage these findings, educational institutions should prioritise investments in building students' technological proficiency, such as through regular training on online platforms, digital tools, and internet navigation. Additionally, university management should integrate self-regulation strategies into their blended programmes, ensuring that instructors actively support students in mastering progress tracking, objective setting, time management, and effective study habits.

Keywords: Distance education, E-learning, Self-regulation skills, Students' readiness for e-learning, Students' satisfaction.

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1. Introduction

The contribution of online education to the field of education is significant, enhancing accessibility for a diverse array of learners. The expansion of digital platforms has enabled students worldwide to access high-quality resources and instruction from anywhere [1, 2]. E-learning, now a dominant educational mode, connects instructors and learners remotely via diverse technologies, despite physical separation [3-5]. In Africa, particularly Ghana, several universities have integrated e-learning into distance education programmes [6, 7]. This evolution permits home-based study, broadening access to higher education and prompting institutions to invest in tools that boost engagement.

The COVID-19 pandemic severely disrupted Ghana's education system, forcing a rapid shift to online formats. Yet, this changes exposed challenges like inadequate internet, devices, resources, instructional quality, assessments, and waning student motivation [8-10]. According to Wei and Chou [11] e-learning readiness demands skills in technology, time management, and motivation. However, many postgraduate distance learners in Ghana lack these, fostering negative views and reduced drive [12, 13]. The precise relationship, where readiness affects satisfaction through self-regulation, remains underexplored in Ghanaian settings. This investigation probes self-regulation and e-learning readiness to foster robust online experiences, addressing a vital knowledge gap for educational advancement.

Numerous studies have evaluated student satisfaction with e-learning [12, 14-22] including a handful in Ghana [23, 24]. While satisfaction research abounds, few examine readiness's impact on it, mediated by self-regulation, especially locally. Thus, this study assesses readiness's effects on satisfaction and the mediation effect of self-regulation skills among Ghanaian university students, crucial for tailoring online learning strategies.

This study pursues four interconnected objectives: to evaluate the influence of students' e-learning readiness on their satisfaction; to examine the impact of self-regulation skills on satisfaction; to ascertain satisfaction levels with e-learning; and to assess the mediation effect of self-regulation skills on readiness and satisfaction among students at the selected Ghanaian universities. Examining factors that shape student satisfaction in e-learning within higher education is imperative, given the global proliferation of such technologies. The findings will equip institutions to hone e-learning strategies through greater focus on readiness and self-regulation, thereby elevating satisfaction. Moreover, these results will inform policymakers in crafting evidence-based initiatives to promote broad e-learning preparedness, yielding improved educational outcomes nationwide.

The article proceeds as follows: the subsequent section focused on literature review, synthesising theoretical and empirical links among e-learning readiness, satisfaction, and self-regulation skills among students. The next sections detail the methodology and data, followed by analysis and policy implications. The final section is the conclusion and suggestion for further studies.

2. Literature Review

2.1. Social Presence Theory

Social presence theory (SPT), a psychological framework introduced by Short, et al. [25] elucidates how people perceive a sense of connection and realism during online exchanges. According to the theory, various communication technologies differ in their ability to foster social presence, the sensation of genuine involvement and interpersonal closeness, largely through the transmission of cues like vocal tones, body language, facial expressions, and gestures [26, 27]. In the context of this research, SPT illuminates how such perceptions shape students' self-regulation skills and, in turn, their overall satisfaction within online learning environment.

Originating from telecommunications research, SPT examines how social media platforms facilitate the sharing of insights and social rapport [28]. A study by Song, et al. [29] describes social presence as the perceived prominence of others in an interaction and the resulting emphasis on relational bonds. Notably, technologies enabling stronger social presence enhance participant engagement [30]. Within e-learning, this can bolster self-regulation by enriching interactions

with instructors, peers, and resources, thereby promoting adaptive learning tactics. The theory particularly stresses the role of communicative exchanges and social signals in influencing student experiences and achievements [31, 32]. This study, therefore, probes the mediation effect, framed by social presence components, on the link between e-learning readiness and satisfaction among postgraduate students at the select Ghanaian universities.

2.2. Hypotheses Development

2.2.1. Students' Readiness for E-Learning and their Satisfaction

This section provides a concise empirical overview of students' e-learning readiness and its effect on their satisfaction. Designing effective virtual learning environments that increase student performance and engagement requires an understanding of these relationships. Some studies report higher satisfaction in online settings, whereas others found insignificant disparities [33, 34]. Such inconsistencies suggest that satisfaction varies due to diverse influences, warranting further scrutiny to refine instructional approaches. According to Martin, et al. [35] students exhibit strong confidence in online platforms but falter in time management and interaction. Unger and Meiran [36] noted initial anxiety and lack of preparation, though these eased over time. A study by Tang, et al. [37] revealed that motivation and study routines critically shape readiness, particularly amid the pandemic.

Research by Elshami, et al. [38]; Hettiarachchi, et al. [39]; Baloran, et al. [40]; Choe, et al. [41] and Zhang and Lin [42] indicates that enhancing communication, interaction, and engagement can improve the overall e-learning readiness and, in turn, satisfaction. For instance, Elshami, et al. [38] noted that, despite technical barriers hindering participation, effective communication and flexibility are key to student satisfaction. Likewise, Muzammıl, et al. [43] showed that strong student–instructor interactions boost engagement and satisfaction. Han, et al. [44] further stressed that interactive online settings enhance satisfaction among EFL learners. Institutions should thus emphasise engagement tactics to improve students satisfaction in digital courses.

A study by Topal [20] identified a clear positive tie between online readiness and e-course satisfaction. Pham, et al. [17] linked satisfaction directly to e-learning service quality, which sustains learner loyalty. According to Bismala and Manurung [15] flexibility, fair assessments, perceived utility, and time management proved key during COVID-19. Yilmaz [22] uncovered a robust connection between e-learning preparation and both satisfaction and motivation in flipped classrooms. Nikou and Maslov [45] established that digital communities, IT accessibility, information quality, and course structure exert a direct positive impact on e-learning satisfaction. Bou-Hamad and El Danaoui [46] pinpointed instructor readiness as the foremost driver of such satisfaction. Siregar [47] showed e-learning readiness mediating the effects of technical skills and motivation on satisfaction. In contrast, Nedeljković and Rejman Petrović [48] found students favouring conventional teaching over online formats for greater satisfaction.

Most inquiries were conducted predominantly in Asia and Europe, for instance, those by Yilmaz [22] and Topal [20] in Turkey, and those by Bismala and Manurung [15] in Indonesia, highlighting the need for Ghana-specific research to determine whether readiness influences satisfaction in the local context. Moreover, most targeted undergraduates or high school students, unlike this investigation which will be done on postgraduate distance learners. Collectively, the reviewed evidence affirms a positive, significant association between e-learning readiness and satisfaction. The study therefore hypothesizes that:

$H_{1:}$ Students' readiness for e-learning positively influences students' satisfaction.

2.2.2. Students' Readiness for E-Learning and Self-Regulation Skills

An empirical overview of students' readiness for e-learning and their self-regulation skills has been discussed in this section. A study Yavuzalp and Bahcivan [49] demonstrated that e-learning readiness significantly affects self-regulation, contentment, and performance. According to Abdelaliem and Elzohairy [50] self-leadership explains 87% of the variance in students' e-learning readiness. Also, Landrum [12] found that students who exhibited excellent self-regulation and confidence in online tools had better satisfaction levels and more positive opinions of digital courses. Such evidence suggests that universities should prioritise developing self-regulation to boost learners' readiness and enjoyment of e-learning. Similarly, A study by Ergun and Adibatmaz [51] indicated that those with clear personal objectives exhibit superior self-regulation, fostering better academic results and involvement in virtual settings. Likewise, Ngampornchai and Adams [52] observed that self-directed learners familiar with social media and mobiles were notably better equipped for online study. Sevim, et al. [53] similarly uncovered a strong link between goal-driven mindsets and e-learning preparedness, which in turn shapes how students perceive the value of digital education. Universities, therefore, could enhance these traits by incorporating goal-setting training and self-regulation workshops.

The majority of reviewed research originates from Asia, for example, studies by Ngampornchai and Adams [52]; Ergun and Adibatmaz [51]; Ucar and Ugurhan [54]; Yavuzalp and Bahcivan [49] and Sevim, et al. [53] all based in Turkey or Thailand. This regional skew warrants exploring e-learning readiness among Ghanaian students to ascertain its impact on self-regulation. Overall, the synthesised evidence points to a clear, positive association self-regulation skills and between e-learning readiness. Therefore, this research hypothesises that:

$H_{2:}$ Students' readiness for e-learning positively influences self-regulation skills.

2.2.3. Self-Regulation Skills and Students' Satisfaction

A number of investigations have discussed the elements shaping success and contentment in online learning settings. According to Artino [55] earlier exposure to online courses, alongside self-efficacy and the perceived worth of tasks, plays a key role in favourable results. Likewise, Landrum [12] observed that students opting for virtual classes exhibited elevated

task value, greater satisfaction, stronger perceived gains in knowledge, and more independent study habits. Also, Inan, et al. [19] examined the role of self-regulation skills in boosting achievement and well-being among online learners. Drawing on the Online Self-Regulation and Learning Questionnaire, it tested core aspects, planning, help-seeking, time management, and self-evaluation, and identified planning as especially vital. Educational institutions, therefore, should emphasise fostering these skills, particularly proactive planning, to support both progress and fulfilment. Learners who approach their studies with deliberate organisation often report heightened enjoyment and a stronger chance of meeting their goals.

Research by Liu, et al. [56] linked a rewarding 'flow' state, marked by enjoyment, immersion, concentration, and a sense of being present, to self-directed learning, overall contentment, and sustained motivation. Tzimas and Demetriadis [57] demonstrated that guidance from learning analytics improves self-regulation skills, academic performance, and learner approval. In a similar vein, Moelans, et al. [58] reported associations between self-regulated learning and enhanced involvement, exertion, and pleasure in virtual extended enterprises. Younis [59] further suggested that incorporating tools like ChatGPT into digital platforms can sharpen self-regulation, thereby enhancing satisfaction with remote education.

The majority of these inquiries targeted undergraduates; for example, those by Younis [59]; Liu, et al. [56]; Landrum [12] and Inan, et al. [19]. By contrast, the present research centres on postgraduates at public universities. Moreover, most of the studies originated in Asia and Europe, including works from Palestine and Turkey [19, 59]] and the Netherlands [58]. Such emphases highlight the value of exploring self-regulation and satisfaction within Ghana's unique landscape. Notably, the reviewed empirical evidence consistently reveals a favourable link between self-regulation skills and student satisfaction. This research, therefore, hypothesises that:

$H_{3:}$ self-regulation skills positively influence students' satisfaction.

2.2.4. Students' Readiness for e-learning through Self-Regulation Skills to Students' Satisfaction

An empirical overview on the mediating role of self-regulation skills between students' e-learning readiness and their satisfaction was discussed in this section. A review of existing research reveals limited investigations into self-regulation as a mediator across various constructs. For instance, a study by Hu, et al. [60] involving 347 first-year Chinese undergraduates in an asynchronous history course during COVID-19 found self-regulated learning significantly mediated the link between social presence and satisfaction. Such findings imply that targeted self-regulation strategies might boost e-learning readiness by strengthening students' capacity to oversee their learning and sustain motivation. In contrast, Ning and Downing [61] reported minimal effects of self-regulation and motivation on academic performance and learning experiences. According to Raver, et al. [62] self-regulation partially mediated gains in children's academic preparedness. Yavuzalp and Bahcivan [49] established that e-learning readiness positively influences academic success, self-regulation abilities, and satisfaction. Likewise, Joseph, et al. [63] showed self-regulation and the home learning environment as mediators linking socioeconomic disadvantage to educational attainment.

Most reviewed studies involved university students, including undergraduates, and were conducted primarily in Europe and China, such as Ning and Downing [61] work in China, alongside efforts in Palestine and Turkey by Yavuzalp and Bahcivan [49] and Joseph, et al. [63] respectively. This geographical skew justifies further investigation of self-regulation's mediating effects within Ghana's educational landscape. Overall, the empirical evidence confirms self-regulation's role in linking key relationships among these variables. Consistent with the preceding literature review, this investigation hypothesises that:

$H_{4:}$ Self-regulation skills play a substantial mediating role in the link between students' readiness for e-learning and their satisfaction.

The conceptual framework outlined in Figure 1 includes every hypothesis explored in this study.

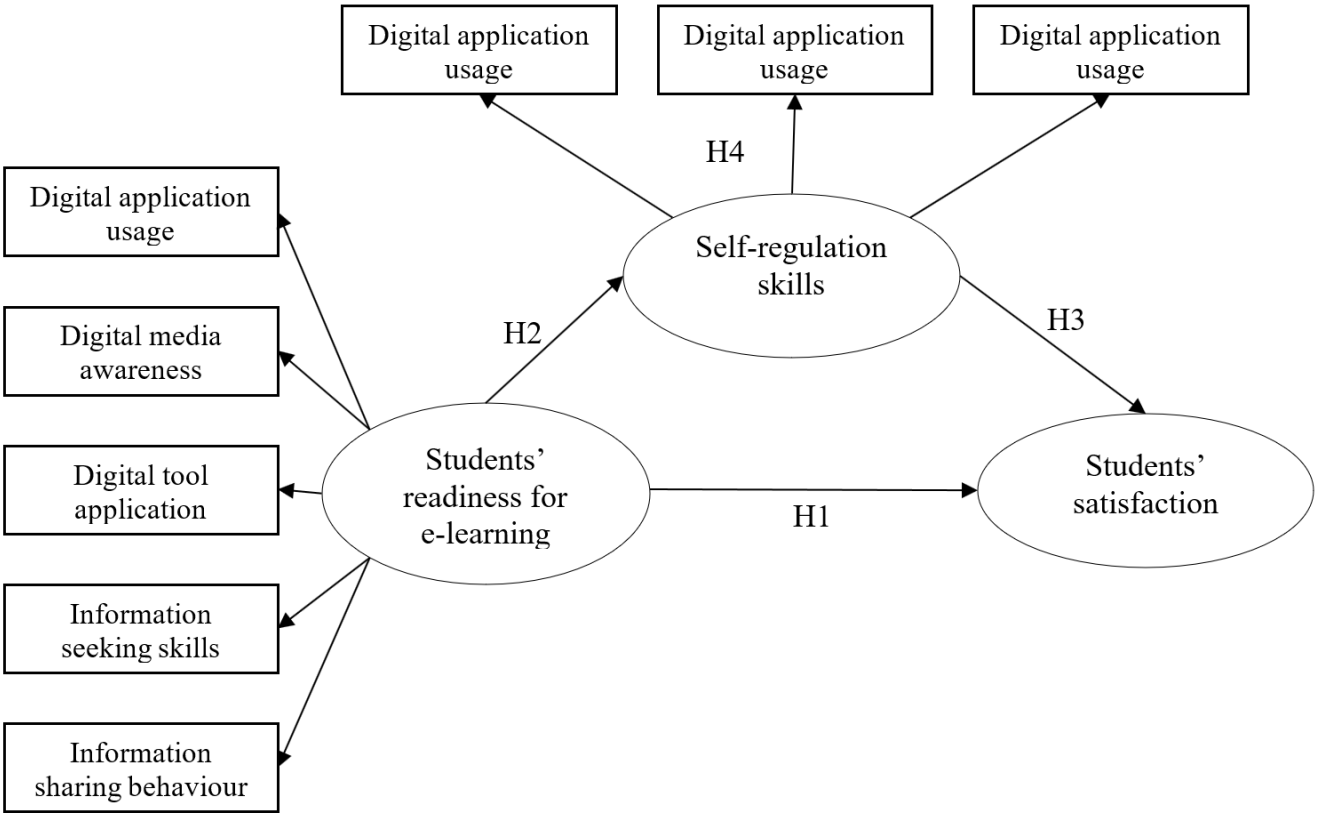

Figure 1.
Study's conceptual framework.

According to Figure 1 students' readiness for e-learning functions as the independent variable, satisfaction acts as the dependent variable, and self-regulation skills serves as the mediator. In this causal chain, the independent variable triggers alterations in the mediator, which subsequently drives changes in the dependent variable [64]. A study by Qin [64] emphasises that incorporating the mediator enables a deeper probe into the connection between e-learning readiness and student satisfaction.

3. Research Methodology

This quantitative study adopted an explanatory design to evaluate the mediating influence of self-regulation skills on the link between e-learning readiness and student satisfaction [65]. Stratified sampling was utilised to select postgraduate distance education students from three established public universities in Ghana: the University of Cape Coast (UCC) [66] the [67] and Kwame Nkrumah University of Science and Technology (KNUST; 1,762 students; MIS-Field Data, 2025), comprising a total population of 5,968. The strata were defined according to institutional affiliation, enabling the capture of disparities in e-learning resources, programme delivery modes, and participant characteristics. In total, 500 valid responses were obtained from this population.

A sample of 500 surpasses the recommended minimum for a population of this size, bolstering statistical robustness and accuracy in the analysis. According to Krejcie and Morgan [68] populations of 5,000 to 6,000 require a sample size of 357 to 361 to attain a 95% confidence level with a 5% margin of error. Notably, using a sample of 500 further strengthens this margin to about 4.3%, thereby boosting the robustness of inferences regarding links between factors such as readiness and satisfaction [69]. Analysis encompassed descriptive measures, frequencies and percentages, alongside structural equation modelling, conducted via SmartPLS V 4.1 and SPSS V 26.

3.1. Participant

The demographic unit was examined using percentages and frequencies. Table 1 displays the summarised results for the demographics of the respondents.

Table 1.
Profile of participants.

Variable	Frequency	Percentage
Institution		
UG, Legon	149	29.80
KNUST	119	23.80
UCC	232	46.40
Age (in years)		
21 – 30	78	15.60
31 – 40	282	56.40
41- 50	95	19.00
above 50	45	9.00
Sex		
Male	340	68.00
Female	160	32.00
Academic Fields		
Business	235	47.00
Arts and Social Science	136	27.20
Mathematics and Sciences	70	14.00
Education	59	11.80
Marital status		
Married	215	43.00
Single	285	57.00
Online learning skills - tools		
Expert	157	31.40
Intermediate	294	58.80
Novice	49	9.80
Online learning skills - Platform(s)		
Advanced	188	37.60
Intermediate	264	52.80
Beginner	48	9.60
Sample size	500	100

Table 1 summarizes the demographics of 500 postgraduate distance education learners from the selected universities in Ghana. The majority (68%) were male, with ages predominantly between 31 to 40 (56.4%). Most respondents held taught postgraduate degrees (54.8%) and studied business programs (47%). A significant portion (57%) were single, and regarding online learning skills, 58.8% were intermediate users, while 52.8% had intermediate knowledge of online platforms.

3.2. Data Processing and Analysis

Data collection involved both online and printed questionnaires administered to participants. Partial least squares structural equation modelling (PLS-SEM) facilitated the assessment of reflective-reflective higher-order constructs, with all variables exhibiting reflective linkages [70]. Reflective models underwent evaluation via construct reliability, item reliability, convergent validity, and discriminant validity. According to Ringle, et al. [71] a hierarchical component model was applied to analyse students' e-learning readiness, incorporating facets such as information-seeking abilities, information-sharing practices, awareness of digital media, and utilisation of digital applications. Structural model validity drew on metrics including coefficients of determination, effect sizes, and predictive relevance. The disjoint two-stage method enabled the modelling and estimation of higher-order constructs within PLS-SEM. Descriptive analyses relied on IBM SPSS version 26, while SmartPLS 4.1 handled inferential statistics [71]. Overall, these techniques laid a robust groundwork for linking indicators to their corresponding constructs.

4. Results and Discussion

This chapter presents the study's findings to address its central research question: To what extent does students' readiness for e-learning influence their satisfaction, and does self-regulation skills as the mediator, mediates this relationship among postgraduate students in the selected Ghanaian universities?

4.1. Assessing the PLS-SEM Results

The characteristics of the study objectives, variables, and inferential statistics required initial quality assessments before addressing the primary research question. These checks statistically verified the instrument and models, following guidelines outlined by Vaithilingam, et al. [72] and Hair and Alamer [70]. Recent research by Kabongo and Mbonigaba [73] and Pokhrel and KC [74] further support this method. This section presents the outcomes of the disjoint two-stage technique (reflective-reflective) applied to the hierarchical component model (HCM). The study’s hypotheses were rigorously tested using PLS-SEM. Higher-order constructs streamline the model by consolidating lower-level elements, as

recommended in works by Vaithilingam, et al. [72]; Hair and Alamer [70] and Becker, et al. [75] alongside contemporary analyses such as those by Nguyen [76], Pokhrel and KC [74]; Sun [77]; Kabongo and Mbonigaba [73] and Hidayat-Ur-Rehman [78]. These sources advocate the disjoint two-stage approach for HCM, enabling separate evaluations of self-regulation skills and students' e-learning readiness as reflective higher-order components. According to Hair and Alamer [70] and Becker, et al. [75] the disjoint two-stage method reduces parameter bias in the structural model. The starting model featured only first-order components, at the basic level. It generated predictions to build higher-order links. First-stage scores then informed the prediction of higher-order constructs in the next phase [79]. The first phase entailed an outer model evaluation using prior prediction results. All measures adopted reflective specifications, so analyses proceeded under reflective principles (Table 2 and Figures 1 and 2).

4.2. Evaluation of Lower Order Construct (LOC) Measurement Model

The reliability and validity of the LOC measurement model were evaluated using four key criteria: item reliability, construct reliability, convergent validity, and discriminant validity. According to Becker, et al. [75] and Ringle, et al. [71] convergent validity was assessed through factor loadings, Cronbach's alpha, composite reliability (ρ_a and ρ_c), and average variance extracted (AVE). Notably, all items for the primary constructs in Table 2 surpassed the 0.7 threshold. Moreover, composite reliability and Cronbach's alpha scores for these constructs go above 0.7, with AVE values all higher 0.5 [71, 75]. This confirms convergent validity for the latent variables (Table 2).

Table 2.
Outer model results for first-order constructs.

Constructs/Associated Indicators	Factor Loadings	Cronbach's alpha	Composite reliability (ρ_a)	Average variance extracted (AVE)	Composite reliability (ρ_c)
Digital Tool Application		0.936	0.937	0.838	0.954
SREL3	0.953				
SREL4	0.912				
SREL2	0.899				
SREL1	0.898				
Information Sharing Behaviour		0.947	0.949	0.864	0.962
SREL16	0.949				
SREL15	0.926				
SREL14	0.925				
SREL17	0.917				
Digital Media Awareness		0.930	0.932	0.877	0.955
SREL10	0.940				
SREL9	0.939				
SREL8	0.929				
Information Seeking Skills		0.928	0.930	0.875	0.954
SREL12	0.948				
SREL11	0.943				
SREL13	0.914				
Digital Application Usage		0.953	0.954	0.915	0.970
SREL6	0.973				
SREL7	0.956				
SREL5	0.940				
Computer/Internet Self efficacy		0.943	0.945	0.898	0.963
SRS1	0.957				
SRS3	0.954				
SRS2	0.931				
Learner Control		0.898	0.904	0.831	0.936
SRS9	0.915				
SRS11	0.928				
SRS10	0.891				
Self-Direction Learning		0.938	0.943	0.803	0.953
SRS8	0.939				
SRS7	0.896				
SRS6	0.888				
SRS5	0.887				
SRS4	0.868				
Student Satisfaction		0.957	0.958	0.854	0.967
SS1	0.944				

Constructs/Associated Indicators	Factor Loadings	Cronbach's alpha	Composite reliability (ρ_a)	Average variance extracted (AVE)	Composite reliability (ρ_c)
SS3	0.935				
SS4	0.920				
SS5	0.914				
SS2	0.906				

Discriminant validity examines how distinctly one construct differs from others [80]. In simple terms, convergent validity checks that items properly measure the same concept, whereas discriminant validity confirms that different scales in the model truly capture separate ideas [81]. According to Ringle, et al. [71] and Becker, et al. [75] researchers commonly use three tests: the heterotrait-monotrait ratio (HTMT), the Fornell–Larcker criterion, and cross-loadings. This study relied on the HTMT approach. A landmark study by Henseler, et al. [81] strongly recommends the HTMT ratio, emphasising that it provides the most accurate estimate of the true correlation between constructs, making it the preferred method for establishing discriminant validity. They propose a threshold of 0.90; values surpassing this signal inadequate discriminant validity. Moreover, the HTMT confidence interval should not include 1. In this analysis, the partial least squares (PLS) model met all HTMT requirements, as presented in Table 3.

Table 3.
Discriminant validity - HTMT (first-order model).

Variable	Student Satisfaction	Self-direction Learning	Learner Control	Information Sharing Behaviour	Information Seeking Skills	Digital tool Application	Digital Media Awareness	Digital Application Usage	Computer Self-efficacy
Student Satisfaction		0.482	0.564	0.473	0.493	0.342	0.429	0.379	0.439
Self-direction Learning			0.563	0.464	0.505	0.491	0.452	0.499	0.44
Learner Control				0.384	0.463	0.381	0.417	0.366	0.462
Information Sharing Behaviour					0.716	0.635	0.634	0.587	0.411
Information Seeking Skills						0.643	0.68	0.646	0.494
Digital tool Application							0.653	0.648	0.423
Digital Media Awareness								0.584	0.498
Digital Application Usage									0.382

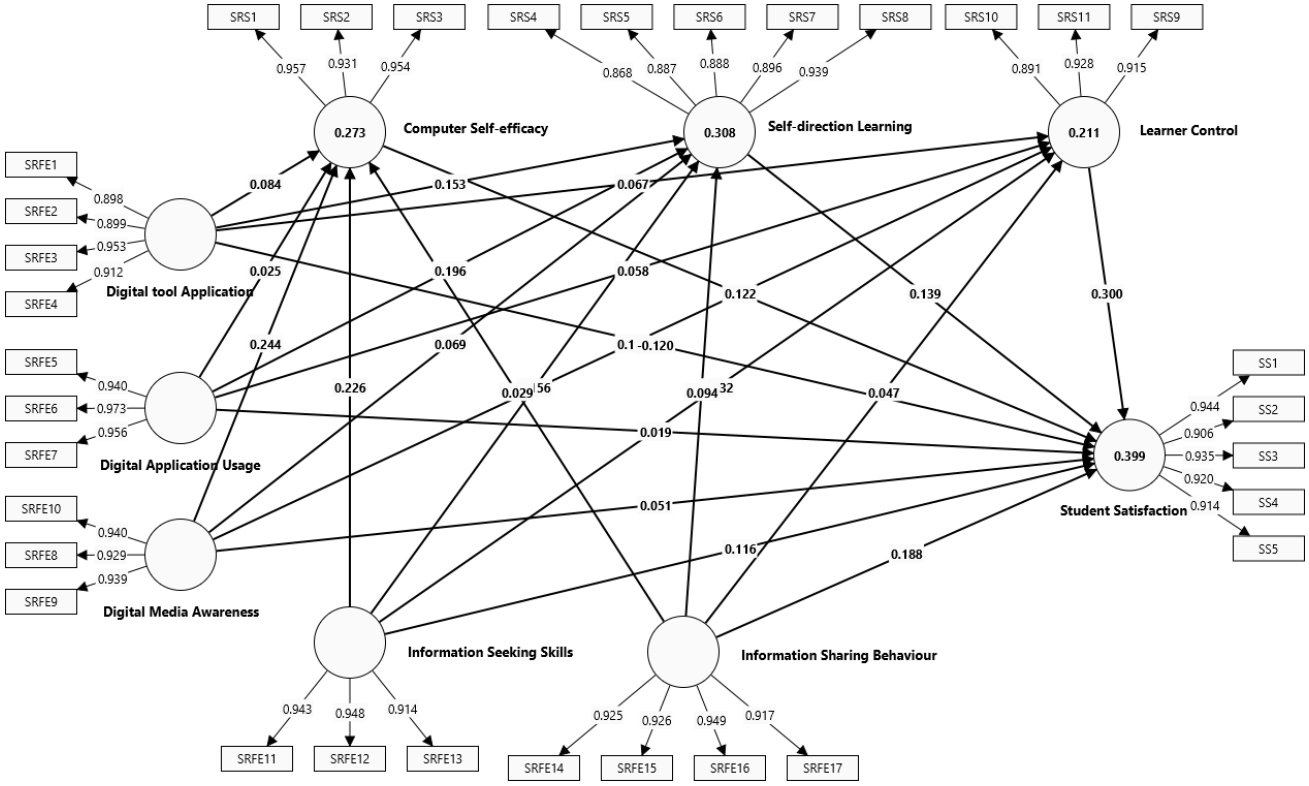

Figure 2.
Evaluation Framework for LOC.

4.3. Evaluation of Higher Order Construct (HOC) Measurement Model

This study adopted a reflective measurement approach for higher-order constructs, same as the approach used for first-order constructs. All subsequent analyses followed this method (Table 4). To minimise potential parameter bias, a reflective-reflective disjoint two-stage approach was applied [79]. At the outset, the model incorporated only first-order constructs, serving as the most basic level (see Figure 2). Scores derived from these first-order constructs then informed estimates of the higher-order constructs in the second stage [79]. The higher-order construct (HOC) measurement model was evaluated using four key criteria: item reliability, construct reliability, convergent validity, and discriminant validity. Items for the primary constructs, as detailed in Table 5, surpassed the necessary thresholds. Cronbach's alpha and composite reliability values exceeded 0.7, and average variance extracted (AVE) figures all surpassed 0.5 [71, 75]. These results confirmed convergent validity for the latent variables (Table 5).

For discriminant validity, the HTMT ratio was employed, as recommended by Becker, et al. [75] and Ringle, et al. [71] for HOC models. All HTMT values reported in Table 4 fell below 0.80. Consequently, the PLS model for the HOC met the HTMT requirements (Table 4).

Table 4.
Discriminant validity - HTMT (second-order model).

Variable	Student Readiness for e-learning	Self-regulation Skills
Student Satisfaction	0.528	0.708
Student Readiness for e-learning		0.793

Table 5.
Outer Model Results for Second-Order Constructs.

Second-order constructs	Associated first-order constructs	Factor Loadings	Cronbach's alpha	Composite reliability (ρ_a)	Composite reliability (ρ_c)	Average variance extracted (AVE)
Students Readiness for e-learning			0.884	0.888	0.915	0.683
	Information Seeking Skills	0.861				
	Information Sharing Behaviour	0.833				
	Digital Media Awareness	0.822				
	Digital Tool Application	0.818				

	Digital Application Usage	0.797				
Self-Regulation Skills			0.713	0.715	0.839	0.636
	Computer/Internet Self efficacy	0.758				
	Learner Control	0.815				
	Self-Direction Learning	0.818				

4.4. The Main Findings (Direct Effect – Objective 1-3)

Table 6 and Figure 3 present the path coefficients from the regression analysis for all examined relationships. Bootstrapping with 5,000 subsamples determined the significance of these coefficients, while multi-group analysis confirmed their robustness across the selected universities. Effects were deemed significant at $p < 0.05$.

For hypothesis 1, students' e-learning readiness positively and significantly influenced satisfaction (β = 0.199, T Stat = 4.043, p = 0.000). This pattern held for KNUST (β = 0.177, T Stat = 1.659) and UCC (β = 0.274, T Stat = 4.223), yet at UG, the link was positive but non-significant (β = 0.118, T Stat = 1.096, p > 0.05). Hypothesis 2 similarly showed a strong positive effect of e-learning readiness on self-regulation skills (β = 0.631, T Stat = 20.294, p = 0.000), consistently supported across institutions: UCC (β = 0.274, T Stat = 13.689), KNUST (β = 0.584, T Stat = 8.313), and UG (β = 0.699, T Stat = 13.681). Finally, hypothesis 3 found that self-regulation skills exerted a notable positive impact on satisfaction (β = 0.460, T Stat = 9.684, p = 0.000), with uniform backing from all three universities: UCC (β = 0.433, T Stat = 6.875), KNUST (β = 0.424, T Stat = 4.230), and UG (β = 0.540, T Stat = 5.120).

Table 6.
Direct and indirect effects for the hypothesized paths.

Relationship	**KNUST**		**UCC**		**UG**		**Complete Sample**	
	Coefficient (β)	**Standard deviation (STDEV)**	**β**	**STDEV**	**β**	**STDEV**	**β**	**STDEV**
H_1: Student Readiness for e-learning -> Student Satisfaction	0.177** (1.659)	0.107	0.274** (4.223)	0.065	0.118 (1.096)	0.107	0.199** (4.043)	0.049
H_2: Student Readiness for e-learning -> Self-regulation Skills	0.584** (8.313)	0.070	0.615** (13.689)	0.045	0.699** (13.681)	0.051	0.631** (20.294)	0.031
H_3: Self-regulation Skills -> Student Satisfaction	0.424** (4.230)	0.100	0.433** (6.875)	0.063	0.540** (5.120)	0.105	0.460** (9.684)	0.047
H_4: Student Readiness for e-learning -> Self-regulation Skills -> Student Satisfaction	0.248** (3.678)	0.067	0.266** (5.966)	0.045	0.377** (4.611)	0.082	0.290** (8.488)	0.034

Note: **p<0.05; *p<0.10. T-stat presented in brackets.

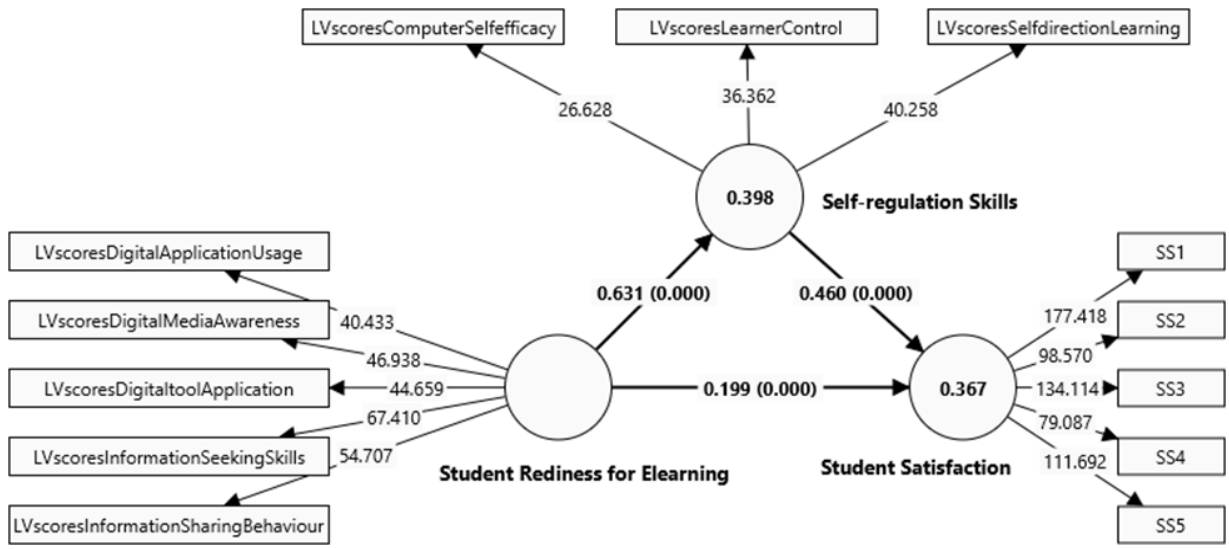

Figure 3.
Evaluation Framework for the HOC with p-values.

4.5. Mediation Result (Indirect Effects - Objective 4)

Drawing on the research conceptual framework, this subsection explores how additional factors influence the conversion of students' e-learning readiness into overall satisfaction. Notably, students' readiness for e-learning show a relationship with their satisfaction, and hypothesis H4 investigates self-regulation skills as a key mediator in this link. To pinpoint the specific indirect effects, 5,000 subsamples were used during the bootstrapping. Moreover, multi-group analysis was conducted to confirm the robustness across the chosen Ghanaian universities. The analysis confirmed that self-regulation skills mediate the connection between e-learning readiness and student satisfaction. The indirect pathway, from readiness through self-regulation to satisfaction, emerged as positive and statistically significant ($\beta = 0.290$, T Stat = 8.488, $p < 0.05$). According to the results from the selected institutions, this pattern held firm: at UCC ($\beta = 0.266$, T Stat = 5.966), KNUST ($\beta = 0.248$, T Stat = 3.678), and UG ($\beta = 0.377$, T Stat = 4.611). Thus, the findings affirm that self-regulation skills serve as an intermediary between e-learning readiness and student satisfaction.

4.6. Discussion of Results

The analysis revealed a significant positive link between students' e-learning readiness and their satisfaction, thus supporting Hypothesis 1. This suggests that efforts to boost technical skills and digital literacy could heighten learner contentment. Such results align with prior work, including studies by Topal [20]; Bou-Hamad and El Danaoui [46]; Pham, et al. [17]; Yilmaz [22]; Bismala and Manurung [15]; Nikou and Maslov [45]; Nedeljković and Rejman Petrović [48] and Siregar [47]. Closer examination showed this association held strongly for students at the UCC and KNUST, yet proved non-significant at the UG. Evidently, for UG students, satisfaction stems from factors beyond mere readiness.

Likewise, e-learning readiness exerted a statistically significant positive influence on self-regulation skills, confirming Hypothesis 2. According to these findings, equipped students are better positioned to adopt strong self-regulation tactics, such as better focus and time management. Institutions might foster greater learner autonomy through targeted training in digital tools, problem-solving, and scheduling. The pattern emerged consistently across UCC, UG, and KNUST cohorts. This outcome echoes research by Abdelaliem and Elzohairy [50]; Ngampornchai and Adams [52]; Ergun and Adibatmaz [51]; Unger and Meiran [36]; Sevim, et al. [53]; Yavuzalp and Bahcivan [49] and Landrum [12]. For instance, Landrum [12] observed that students with high self-regulation and self-efficacy in online tools reported more favourable views of courses and higher overall satisfaction.

In addition, self-regulation skills positively and significantly predicted student satisfaction, upholding Hypothesis 3. Notably, this mirrors evidence from Inan, et al. [19]; Liu, et al. [56]; Artino [55]; Tzimas and Demetriadis [57]; Younis [59] and Moelans, et al. [58]. The connection proved robust among students at UCC, UG, and KNUST alike.

Finally, self-regulation skills served as a significant mediator in the pathway from e-learning readiness to satisfaction, validating Hypothesis 4. While direct parallels are scarce, related investigations highlight self-regulation's mediating role in nearby dynamics: for example, studies by Hu, et al. [60]; Ning and Downing [61], Yavuzalp and Bahcivan [49]; Joseph, et al. [63] and Raver, et al. [62]. The mediation held firm across the UCC, UG, and KNUST groups.

5. Conclusion and Recommendations

5.1. Conclusions

The research indicates that e-learning readiness directly boosts student satisfaction. Those proficient in technical skills, such as uploading media, handling data, and engaging on digital platforms, report higher contentment with their online experiences. According to these findings, such preparedness enables smoother navigation of virtual spaces, heightens involvement, and builds a sense of achievement. In turn, satisfaction with course content and instructor interactions supports stronger academic results.

Likewise, e-learning readiness markedly strengthens self-regulation abilities. Students skilled in tasks like software operation, spreadsheet use, and media management gain better control over their studies. This proficiency aids in setting goals, prioritising time, and staying focused amid online demands. It also equips learners to overcome hurdles, including effective online help-seeking and internet navigation, fostering a more organised and self-directed approach to remote education.

Moreover, self-regulation skills play a key role in elevating satisfaction with online learning. Effective goal-setting, time allocation, and concentration help students thrive in digital settings. Those who proactively seek support or review resources adapt more readily, with their confidence in tools and internet use creating fluid, fulfilling experiences. Notably, these learners appreciate the process and show greater openness to future e-learning pursuits.

In essence, self-regulation acts as a vital bridge between e-learning readiness and satisfaction. By facilitating goal monitoring and strategy adjustments, it counters issues like distractions or data overload. A study like this one highlights the need for integrated self-regulation training in curricula, through targeted guidance, to enrich digital learning journeys holistically.

5.2. Recommendations of the Study

Drawing on the study’s findings, targeted measures can markedly improve the impact of online education and learner achievement. The research highlights a clear positive association between e-learning readiness and student satisfaction, implying that universities ought to prioritise building technical proficiency and digital capabilities through targeted workshops on virtual platforms and tools. Moreover, incorporating self-regulation techniques, like establishing goals, monitoring advancement, managing time, and delivering tailored feedback, can substantially elevate contentment. According to the findings, such institutions should embed explicit guidance on these skills within e-learning curricula.

Furthermore, as self-regulation mediates the link between readiness and satisfaction, a study like this one recommends developing holistic support frameworks to cultivate these abilities, thereby indirectly fostering greater fulfilment in digital learning spaces.

5.3. Suggestions for Further Research

This research recommends additional studies on self-regulation skills, e-learning readiness, and satisfaction among students. It suggests using different methodologies, perspectives, and data processing methods to gain in-depth insights. Methods such as interviews and focus groups in qualitative research offer profound understanding of students' viewpoints and drives. These techniques particularly excel in capturing the personal experiences that quantitative approaches might overlook. The study also suggests conducting further research into different student groups, such as those on regular or sandwich programs, to understand their perceptions and self-regulation practices. Such a method uncovers the core drivers behind the detected associations, yielding a richer insight into the topic.

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