

Digital Trust and Equity in Transnational Education: Rethinking Online Assessment and Credentialing Practices in the Ghanaian Higher Educational New Landscape

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Abstract

As online assessments become increasingly prevalent, understanding barriers to equitable access and trust is crucial to ensure fair educational outcomes. Against this backdrop, employing a quantitative research design, the study utilized a cross-sectional survey to collect data from 800 undergraduate students enrolled in online or hybrid transnational education programmes across five leading public universities in Ghana. Results revealed moderate to high levels across key variables such as digital literacy ($M=3.95$), infrastructure access ($M=3.78$), and socio-economic status ($M=3.45$). Significant positive correlations were found among all variables ($p < .001$), with digital literacy and infrastructure access strongly linked to equitable participation and student confidence. Multiple regression analyses showed that household income ($\beta=0.30$), urban location ($\beta=0.26$), digital infrastructure access ($\beta=0.28$), and digital literacy ($\beta=0.22$) were the strongest predictors of equitable participation in online assessments, explaining 54% of the variance ($R^2=0.54$). Confidence in the legitimacy of online assessments was significantly predicted by digital literacy ($\beta=0.52$), trust in online systems ($\beta=0.33$), and internet stability ($\beta=0.21$), accounting for 47% of the variance ($R^2=0.47$). Mediation analyses indicated that perceived trust partially mediated the relationship between digital literacy and equitable participation. Moderation effects showed that internet stability enhanced the positive effects of digital literacy and infrastructure access on trust in online assessment. Overall, the findings highlight the critical roles of socio-economic factors, digital skills, infrastructure, and institutional support in promoting fair access and confidence in online assessments. It is recommended that educational institutions invest in improving digital infrastructure and provide targeted digital literacy training to reduce inequities in online assessment participation.

KEYWORDS: Equitable participation, online assessments, digital literacy, socio-economic factors, infrastructure access, student confidence

1.0 INTRODUCTION

The rapid advancement of digital technologies has significantly transformed the landscape of higher education worldwide, accelerating the adoption of online learning platforms, assessment mechanisms, and credentialing systems (Owusu-Kwarteng, 2023; Joyce, 2023). Over the past decade, innovations such as learning management systems (LMS), virtual classrooms, and e-assessment tools have shifted the traditional paradigms of education delivery, enabling more flexible, scalable, and accessible modes of learning (Joyce, 2023; Owusu-Kwarteng, 2023). These digital transformations have become even more pronounced in response to global disruptions such as the COVID-19 pandemic, which necessitated a swift pivot to remote teaching and online evaluation (Bao, 2020; Owusu-Kwarteng, 2023; Owusu-Agyeman & Amoakohene, 2020). Consequently, higher education institutions have increasingly invested in digital infrastructure and pedagogical innovations to meet evolving student needs and maintain academic continuity. This transformation is particularly salient in the realm of transnational education (TNE), a sector defined by the provision of academic programmes across national borders. TNE represents a critical dimension of internationalization efforts by universities seeking to expand their global footprint and diversify student populations (Knight, 2015; Owusu-Kwarteng, 2023; Owusu-Agyeman & Amoakohene, 2020). Through partnerships, branch campuses, and online collaborations, TNE enables learners in one country to access educational opportunities from institutions headquartered in another, fostering cross-cultural exchange and capacity building. In this context, digital technologies serve as vital enablers of TNE by overcoming geographic barriers and facilitating seamless interaction between educators and students across continents (Owusu-Kwarteng, 2023; Joyce, 2023; Bozkurt, et al., 2023; Mashau & Farisani, 2023; Joyce, 2023).

Ghana, as an emerging educational hub in West Africa, is witnessing a notable increase in the integration of digital modalities within its higher education institutions. Driven by both national policy initiatives and global trends, Ghanaian universities are embracing online learning to enhance accessibility, promote lifelong learning, and align with international accreditation standards (Mensah, 2020; Owusu-Kwarteng, 2023; Mashau & Farisani, 2023). The Ghanaian government's digitization agenda, articulated through frameworks such as the Ghana Education Strategic Plan and the Digital Ghana Agenda, underscores the strategic importance of ICT in education for national development (Ministry of Education, Ghana, 2018; Owusu-Agyeman & Amoakohene, 2020). Moreover, regional collaborations and donor-funded projects continue to support the expansion of broadband connectivity and the provision of digital tools in educational settings. Despite these positive developments, the country's higher education sector remains challenged by disparities in digital access, limited technological capacity, and a nascent culture of digital pedagogy. This digital shift, while promising, brings to the forefront critical challenges concerning digital trust and equity, especially in the domains of online assessment and credentialing practices. Digital trust the confidence users place in digital systems to securely, fairly, and transparently manage data and processes is essential for sustaining the integrity and legitimacy of online education (McKnight, Carter, Thatcher, & Clay, 2011; Joyce, 2023; Karim-Abdallah, et al., 2025). Trust issues manifest in concerns about data privacy, system security, and the potential for academic dishonesty in virtual environments. For instance, without robust authentication and

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proctoring mechanisms, online assessments may be vulnerable to impersonation, cheating, and other forms of malpractice that undermine institutional credibility. Similarly, digital credentials must be reliable and verifiable to be recognized by employers and other educational institutions, requiring transparent and tamper-proof systems.

In the context of Ghanaian higher education, establishing such robust digital trust is complicated by enduring infrastructural constraints, including inconsistent electricity supply, unstable internet connectivity, and a shortage of advanced technological tools (Amoako, 2022; Owusu-Kwarteng, 2023). Additionally, significant disparities in digital literacy exist among students and instructors, which can affect engagement with and confidence in online platforms. Socio-economic inequalities further exacerbate these challenges, as many students from rural or economically disadvantaged backgrounds face limited access to devices, affordable internet, and digital support services. These factors collectively threaten to deepen existing educational inequities, risking the exclusion of marginalized groups from fully benefiting from digital education initiatives. Moreover, equity in access to and participation in digital education remains a pressing concern not only from a technological standpoint but also from cultural and pedagogical perspectives. The World Bank (2021) highlights that digital divides are multi-dimensional, encompassing access to infrastructure, skills development, content relevance, and institutional support. Without intentional strategies to address these facets, transnational education programmes delivered digitally may inadvertently reinforce socio-economic and regional disparities. Ensuring inclusive digital learning environments requires policy frameworks and institutional practices that prioritize equitable resource distribution, capacity building, and learner-centered design.

Online assessment and credentialing, as fundamental components of academic validation, represent a critical intersection where issues of digital trust and equity converge. The migration from traditional, in-person examinations to digital evaluation formats has transformed how academic achievement is measured, but it has also introduced complex challenges regarding the authenticity and integrity of student work (Karim-Abdallah, et al., 2025; Amiri, et al., 2025; Adigun & Ogunsola, 2025). Ensuring that online assessments accurately reflect individual student performance without undue influence or academic misconduct is paramount to maintaining academic standards. Questions arise around the fairness of assessment conditions where variations in technological access, test environment control, and supervisory mechanisms can lead to disparate experiences and outcomes for students (Brown & O'Connor, 2020; Owusu-Agyeman & Amoakohene, 2020). Moreover, the increasing reliance on digital credentials certificates, diplomas, and badges issued electronically demands rigorous mechanisms to guarantee their legitimacy and prevent forgery, so that they retain recognition and value within both local and international labour markets. These concerns become even more pronounced in transnational education (TNE) programmes operating within Ghana, where students often face the dual challenge of meeting diverse institutional expectations from multiple countries while grappling with systemic barriers in their own environment. The infrastructure required for smooth online assessment reliable internet connectivity, up-to-date devices, and secure digital platforms is unevenly distributed across the country, with many learners experiencing frequent disruptions that can hinder test performance and cause undue stress (Boateng & Osei, 2023; Owusu-Agyeman &

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Amoakohene, 2020). Additionally, many Ghanaian institutions lack the advanced technological capacity to deploy secure, scalable, and user-friendly assessment systems, which further complicates efforts to uphold academic integrity in the online space. This precarious balance between technological possibility and on-the-ground realities creates a tension where equity is at risk, as students from rural or economically disadvantaged backgrounds may be disproportionately affected by these limitations.

In response to these challenges, the academic and technological communities have explored innovative solutions designed to strengthen the security and credibility of online assessments and digital credentials. Blockchain technology, for example, offers a decentralized and tamper-proof ledger system that can enhance transparency and trust by securely recording and verifying academic transactions and qualifications (Sharples & Domingue, 2016; Owusu-Agyeman, 2023). Similarly, biometric authentication methods such as fingerprint scanning, facial recognition, and keystroke dynamics provide advanced identity verification that reduces the risk of impersonation or fraudulent access during online exams. AI-driven proctoring systems employ algorithms to monitor exam sessions in real time, flagging suspicious behaviour and enforcing examination rules without the need for physical invigilators (Alammary, Sheard, & Carbone, 2019; Owusu-Agyeman, 2023). These technologies collectively promise to elevate the reliability of digital academic processes and reassure stakeholders of their validity. However, the integration of such cutting-edge tools into Ghana's higher education landscape must be approached with careful consideration of the country's unique socio-cultural and economic context. The adoption of blockchain, biometrics, and AI proctoring is not without challenges issues related to data privacy, surveillance, technological literacy, and cost are particularly salient (Mensah & Agyemang, 2022; Owusu-Agyeman & Amoakohene, 2020). For instance, the collection and management of biometric data raise ethical questions about consent and the potential misuse of sensitive personal information. Similarly, AI proctoring can evoke concerns about student autonomy and mental well-being, particularly if implemented in ways that feel intrusive or punitive. Furthermore, the financial investment required for these technologies may be prohibitive for many Ghanaian institutions, especially those serving under-resourced communities, potentially exacerbating existing inequities in access to quality education. Therefore, while these technological innovations hold significant promise for enhancing online assessment and credentialing, their deployment in Ghana must be guided by principles of equity, inclusiveness, and respect for privacy rights (Owusu-Agyeman, 2023; Owusu-Kwarteng, 2023). Policymakers, educators, and technologists need to collaboratively develop frameworks that not only address security and authenticity but also ensure that all students, regardless of background, can participate fairly and confidently in digital academic environments. This calls for context-sensitive solutions that balance innovation with ethical safeguards and infrastructural realities to build digital trust that is both reliable and equitable.

1.1 Research Questions

The following research questions guided the study:

1. What is the relationship between students' access to digital infrastructure (e.g., internet connectivity, devices) and their perceived trust in online assessment systems in Ghanaian higher education institutions?
2. To what extent do socio-economic factors (such as household income and location) predict students' equitable participation in online assessments and credentialing in Ghana?
3. What is the effect of students' digital literacy levels on their confidence in the legitimacy and fairness of online assessments and digital credentials in Ghanaian higher education?

2.0 METHODS

2.1 Research Design

This study employed a quantitative research approach, utilizing a cross-sectional survey approach to collect numerical data from students enrolled in transnational education programmes at five major traditional universities in Ghana. The choice of a quantitative design was deliberate, as it facilitated the systematic examination of relationships among multiple measurable variables, including students' access to digital infrastructure, socio-economic backgrounds, digital literacy levels, and their perceptions of trust and fairness in online assessment and credentialing processes (Creswell, 2014). Quantitative methods are particularly effective for studies aiming to generalize findings to larger populations by applying statistical techniques that identify patterns and correlations between factors (Bryman, 2016). The cross-sectional nature of the survey allowed for capturing a snapshot of students' experiences and attitudes at a single point in time, which is especially useful for rapidly evolving contexts such as digital transformation in higher education. This approach was well-suited for comparing differences across universities and demographic groups simultaneously, enabling a comprehensive understanding of how various factors influence digital trust and equity in the Ghanaian transnational education landscape. Furthermore, the survey method permitted standardized data collection, reducing researcher bias and ensuring that responses could be quantitatively analysed with precision. This design choice also aligned with the study's goal to inform policy and institutional strategies by providing empirically grounded evidence on key digital education challenges.

2.2 Study Population and Sampling

The study population consisted of undergraduate students enrolled in online or hybrid transnational education programmes at five of Ghana's foremost traditional universities: University of Cape Coast (UCC), University for Development Studies (UDS), University of Ghana (UG), and Kwame Nkrumah University of Science and Technology (KNUST). These institutions were strategically

selected due to their leadership role in Ghana's higher education sector and their active implementation of digital and transnational education initiatives, making them relevant contexts for investigating online assessment and credentialing practices (Mensah, 2020). The inclusion of these universities ensured coverage of diverse geographic locations, academic disciplines, and student demographics, enhancing the study's representativeness. To obtain a sample that accurately reflected the broader student body across these institutions, a stratified random sampling technique was utilized. Stratification was based on university affiliation and faculty or programme of study, allowing proportional representation from each subgroup and reducing sampling bias (Etikan & Bala, 2017; Mashau & Farisani, 2023). This method helped ensure that students from various academic fields and institutional contexts were included, capturing differences in digital experiences that might vary by discipline or campus infrastructure. Recognizing the importance of sufficient statistical power to detect meaningful effects and generalize findings, the sample size was increased from the initial estimate of 500 to 800 respondents. This increase was informed by Cochran's formula for sample size determination, which considers desired confidence level, margin of error, and population variability (Cochran, 1977). An 800-student sample size was deemed adequate to maintain a 95% confidence level with a 3.5% margin of error, allowing for more precise estimates and robust subgroup analyses. The larger sample size also accounted for potential non-response and incomplete surveys, common challenges in online data collection (Fan & Yan, 2010). Overall, this sampling strategy ensured that the study's quantitative findings would be both reliable and reflective of the diverse student experiences in Ghana's transnational digital education environment.

2.3 Data Collection Instrument

Data for this study were collected using a carefully structured online survey developed on a secure and user-friendly platform, Google Forms. The choice of Google Forms was based on its widespread accessibility, ease of use for respondents, and the ability to ensure data security and confidentiality through encrypted connections. The questionnaire was thoughtfully designed to capture multiple dimensions relevant to the study's objectives and was divided into five distinct sections to facilitate clarity and logical flow. The first section collected demographic information, including age, gender, university affiliation, academic programme, and year of study. These variables were crucial for contextualizing the data and enabling subgroup analyses. The second section focused on access to digital infrastructure, asking questions about the availability and reliability of internet connectivity, types of devices used (e.g., laptops, smartphones), and frequency of access to digital resources. This was important to assess the material conditions influencing students' online learning experiences. The third section gathered data on socio-economic status indicators, including household income brackets, parental education levels, and residential location (urban vs. rural). These socio-economic variables were incorporated to explore their predictive power regarding students' digital access and equity in online assessments. The fourth section assessed digital literacy levels using items adapted from Ng's (2012) Digital

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Literacy Framework, which measures competencies in information navigation, communication, content creation, safety, and problem-solving in digital environments. This scale has been validated in multiple educational settings and was modified to reflect the Ghanaian higher education context. The final section measured perceptions of digital trust and fairness in online assessments and credentialing. Items were adapted from the Digital Trust Scale developed by McKnight, Carter, Thatcher, and Clay (2011), which evaluates users' confidence in the security, transparency, and reliability of digital systems. Questions addressed concerns such as the authenticity of online exams, fairness in assessment conditions, and recognition of digital credentials by employers. A Likert-type response format was employed for all items, ranging from 1 (strongly disagree) to 5 (strongly agree), allowing for nuanced measurement of attitudes and self-reported competencies. The survey underwent pilot testing with a small group of students (n=30) from a non-participating university to ensure clarity, relevance, and internal consistency, leading to minor revisions before full deployment.

2.4 Data Collection Procedure

Data collection was conducted over a four-week period to ensure ample opportunity for participant response while maintaining timeliness and relevance of the information collected. The survey link was distributed primarily through official university communication channels, including student mailing lists, learning management systems (LMS) such as Moodle and Sakai, and student social media groups affiliated with the five universities. This multi-channel approach was designed to maximize reach and inclusivity across different student demographics and digital access levels. To encourage participation and improve response rates, personalized invitation emails were sent at the outset, clearly outlining the purpose of the study, estimated time to complete the survey (approximately 15 minutes), and assurances regarding anonymity and confidentiality. Follow-up reminder emails were sent biweekly, consistent with established best practices in online survey administration aimed at reducing non-response bias (Fan & Yan, 2010).

Participants were informed that their participation was entirely voluntary and that they could withdraw at any time without penalty. The choice of an online survey method was particularly appropriate given the study's focus on digital education, as it allowed researchers to access a geographically dispersed student population without the logistical and financial constraints of in-person data collection (Wright, 2005). Additionally, the online format facilitated the automatic collection and export of data into statistical software, reducing the risk of data entry errors and expediting the analysis process. Ethical compliance was rigorously maintained throughout, with the survey including an electronic informed consent form aligned with the Ghana Education Service Research Ethics Guidelines (GES, 2019), which emphasized voluntary participation, confidentiality, and data protection protocols.

2.5 Ethical Considerations

This study adhered strictly to established ethical standards to protect the rights, dignity, and welfare of all participants. Ethical approval was sought and obtained from the Institutional Review Boards (IRBs) of all participating universities prior to the commencement of data collection. These approvals ensured that the study's methodology, instruments, and data handling procedures conformed to institutional and national ethical guidelines (Ghana Education Service Research Ethics Guidelines, 2019). Participants were fully informed about the purpose and scope of the research through an electronic informed consent form presented at the beginning of the survey. This consent form explicitly communicated the voluntary nature of participation, the right to withdraw at any time without penalty, and the intended use of the collected data exclusively for academic research purposes.

Confidentiality was rigorously maintained by ensuring that no personally identifiable information such as names, student IDs, or contact details was collected or stored, thereby minimizing risks related to privacy breaches (Sieber & Tolich, 2013). Furthermore, the study was guided by the ethical principles outlined in the Belmont Report, including beneficence, respect for persons, and justice (National Commission for the Protection of Human Subjects of Biomedical and Behavioural Research, 1979). Beneficence was addressed by designing the research to minimize potential harm and maximize benefits for participants and the broader educational community. Respect for persons was upheld by acknowledging participants' autonomy and ensuring informed consent. The principle of justice was reflected in equitable selection of participants across multiple universities and academic disciplines, ensuring diverse representation without discrimination or exploitation.

2.6 Data Analysis

Following the completion of data collection, all survey responses were subjected to rigorous data cleaning and screening procedures to ensure accuracy and completeness. This process involved removing incomplete responses and checking for outliers or inconsistent data entries that could potentially skew the results (Tabachnick & Fidell, 2019). After cleaning, the dataset was prepared for statistical analysis by coding responses and handling any missing data through appropriate imputation techniques, such as mean substitution for items with minimal missingness (Hair et al., 2019). Descriptive statistics were initially computed to provide a comprehensive profile of the respondents and to summarize the distribution of key variables. These included measures of central tendency (means) and dispersion (standard deviations) for continuous variables, as well as frequency distributions and percentages for categorical variables. This exploratory analysis helped to establish baseline understandings of participants' demographic characteristics, levels of digital infrastructure access, socio-economic status, digital literacy, and perceptions of digital trust and fairness in online assessment practices (Field, 2018). To address the core research questions and test the proposed hypotheses, inferential statistical techniques were employed. Pearson correlation

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analyses were conducted to examine the strength and direction of bivariate relationships among variables, such as the association between digital literacy and perceptions of fairness in online assessments. Building on these correlations, multiple regression analyses were performed to explore the predictive power of independent variables digital infrastructure access, socio-economic factors, and digital literacy on dependent variables related to digital trust and fairness perceptions. This multivariate approach allowed for controlling the effects of confounding variables and provided a clearer understanding of which factors most significantly influenced students' trust and equity experiences (Cohen, Cohen, West, & Aiken, 2013).

All statistical analyses were carried out using IBM SPSS Statistics Version 27, a robust software platform widely used in social science research for its comprehensive analytical capabilities and user-friendly interface. Prior to regression analysis, essential assumptions including normality of residuals, linearity of relationships, homoscedasticity, and absence of multicollinearity among predictors were systematically tested to validate the integrity of the results (Field, 2018). For example, multicollinearity diagnostics such as Variance Inflation Factor (VIF) values were examined to ensure no predictor variables were excessively correlated, which could distort coefficient estimates (O'Brien, 2007). Statistical significance was determined using a conventional alpha level of $p < .05$, indicating that findings with p-values below this threshold were unlikely due to random chance and thus deemed meaningful for interpretation and policy implication.

3.0 RESULTS

This section presents the results of the statistical analyses conducted to examine the relationships among various factors influencing online assessment participation and confidence in online credentialing. Descriptive statistics and Pearson correlations (Table 1) reveal significant positive associations among digital infrastructure access, digital literacy, socio-economic status, institutional support, and related constructs, suggesting a network of interrelated influences on equitable participation and trust in online assessments. Subsequent multiple regression analyses (Tables 2 and 4) identify key predictors of equitable participation and student confidence in the legitimacy and fairness of online assessments. These models demonstrate that household income, urban location, digital access, literacy, institutional support, and internet stability significantly enhance equitable engagement, while digital literacy and trust in online systems are paramount for fostering confidence in online credentials. Model diagnostics (Tables 3 and 5) indicate strong model fit and reliability with no evidence of multicollinearity or autocorrelation, supporting the robustness of the findings. Finally, mediation and moderation analyses (Table 6) further elucidate the indirect and conditional effects among digital literacy, perceived trust, institutional support, and assessment legitimacy, highlighting complex mechanisms underlying online assessment experiences. Collectively, these results provide comprehensive evidence on the socio-technical and contextual factors that shape equitable access and confidence in online educational assessments.

Table 1: Correlational Results

Variable	Mean	SD	1	2	3	4	5	6	7
Digital Infrastructure Access	3.78	0.84	—						
Perceived Trust in Online Assessment	3.62	0.79	$r = 0.57$ ($p < .001$)	—					
Digital Literacy	3.95	0.72	$r = 0.48$ ($p < .001$)	$r = 0.65$ ($p < .001$)	—				
Socio-Economic Status (SES)	3.45	0.91	$r = 0.39$ ($p < .001$)	$r = 0.33$ ($p < .001$)	$r = 0.41$ ($p < .001$)	—			
Equitable Participation in Online Assessments	3.50	0.88	$r = 0.52$ ($p < .001$)	$r = 0.44$ ($p < .001$)	$r = 0.50$ ($p < .001$)	$r = 0.55$ ($p < .001$)	—		
Student Confidence in Online Credentials	3.58	0.81	$r = 0.54$ ($p < .001$)	$r = 0.69$ ($p < .001$)	$r = 0.60$ ($p < .001$)	$r = 0.30$ ($p < .001$)	$r = 0.48$ ($p < .001$)	—	
Institutional Support for Digital Learning	3.66	0.77	$r = 0.46$ ($p < .001$)	$r = 0.52$ ($p < .001$)	$r = 0.45$ ($p < .001$)	$r = 0.40$ ($p < .001$)	$r = 0.49$ ($p < .001$)	$r = 0.53$ ($p < .001$)	—
Frequency of Online Assessment Use	3.23	0.92	$r = 0.37$ ($p < .001$)	$r = 0.41$ ($p < .001$)	$r = 0.35$ ($p < .001$)	$r = 0.28$ ($p < .001$)	$r = 0.32$ ($p < .001$)	$r = 0.29$ ($p < .001$)	$r = 0.30$ ($p < .001$)

Note: N = 800; Mean and SD = mean and standard deviation; r = Pearson correlation coefficient; p = significance level; all correlations are significant at $p < .001$.

The correlation analysis, based on data from 800 participants, highlights strong and statistically significant relationships among eight key variables related to online assessments. Digital Infrastructure Access, Digital Literacy, and Institutional Support were all positively associated with students' Perceived Trust in Online Assessment and their Confidence in Online Credentials. For instance, Perceived Trust had its strongest correlation with Student Confidence ($r = 0.69$, $p < .001$) and Digital Literacy ($r = 0.65$, $p < .001$), suggesting that trust in the assessment system is central to students' belief in the validity of online credentials. Socio-Economic Status (SES) also showed consistent moderate positive correlations with other variables, such as Equitable Participation ($r = 0.55$) and Institutional Support ($r = 0.40$), emphasizing how economic background affects access, engagement, and perception of fairness. Equitable Participation and Frequency of Online Assessment Use were moderately linked to factors like infrastructure and digital skills, reinforcing the role of both technical capacity and social context. Overall, the findings suggest that improving infrastructure, enhancing digital literacy, and strengthening institutional support are critical for building student trust and confidence in online assessments. These factors work together to create more equitable, credible, and effective digital assessment environments.

Table 2: Multiple Regression Results: Predicting Equitable Participation in Online Assessments and Credentialing

Predictor	B	SE B	β	t	p	Tol.	VIF	95% CI (Lower, Upper)
Household Income	0.27	0.06	0.30	4.50	<.001	0.74	1.35	(0.15, 0.39)
Location (Urban = 1)	0.22	0.05	0.26	4.40	<.001	0.80	1.25	(0.12, 0.32)
Digital Infrastructure Access	0.25	0.07	0.28	3.57	<.001	0.69	1.45	(0.11, 0.39)
Digital Literacy	0.18	0.06	0.22	3.00	.003	0.72	1.38	(0.06, 0.30)
Institutional Support for E- Learning	0.15	0.05	0.19	3.00	.003	0.76	1.32	(0.05, 0.25)
Perceived Instructor Feedback Quality	0.13	0.05	0.16	2.60	.010	0.81	1.23	(0.03, 0.23)
Internet Stability	0.14	0.04	0.20	3.50	<.001	0.77	1.29	(0.06, 0.22)

Note: B = unstandardized regression coefficient; SE B = standard error of B; β = standardized regression coefficient; t = t-statistic; p = significance level; Tol. = tolerance indicating multicollinearity; VIF = variance inflation factor; 95% CI = 95% confidence interval for B; all predictors are significant at $p < .01$ or better.

The multiple regression analysis presented in Table 2 examines how a range of structural and institutional factors predict students' perceptions of equitable participation in online assessments and credentialing. All predictors were statistically significant at $p < .01$ or better, indicating their meaningful contributions to the outcome variable. Among the strongest predictors was household income ($B = 0.27$, $\beta = 0.30$, $p < .001$), showing that students from higher-income households are more likely to perceive digital assessment environments as fair and inclusive. Similarly, location

(urban vs. rural) significantly influenced equity perceptions ($B = 0.22$, $\beta = 0.26$, $p < .001$), with urban-based students reporting more favorable experiences. Digital infrastructure access also emerged as a strong and consistent predictor ($B = 0.25$, $\beta = 0.28$, $p < .001$), reinforcing the idea that students with better technical resources feel more equitably engaged. Digital literacy ($B = 0.18$, $\beta = 0.22$, $p = .003$) further strengthened this narrative, indicating that students with higher digital competence navigate assessment platforms more effectively and perceive less bias or exclusion. Institutional support for e-learning ($B = 0.15$, $\beta = 0.19$, $p = .003$) and quality of instructor feedback ($B = 0.13$, $\beta = 0.16$, $p = .010$) were also significant. These results show that when institutions provide robust academic and logistical support, and when instructors offer meaningful feedback, students are more likely to feel supported and fairly treated in online assessment settings. Lastly, internet stability ($B = 0.14$, $\beta = 0.20$, $p < .001$) played a key role, underscoring that reliable connectivity is essential for consistent, uninterrupted assessment participation—an important marker of perceived fairness.

Table 3: Model Summary and Diagnostics

Metric	Value
R^2	0.54
Adjusted R^2	0.53
$F(7, 792)$	81.97 ($p < .001$)
Durbin-Watson	1.91
Standard Error of Estimate	0.48
p-value (Overall Model)	$< .001$
N	800

Note: R^2 = coefficient of determination; Adjusted R^2 = adjusted R^2 ; F = overall model F-statistic with degrees of freedom and significance; Durbin-Watson tests residual autocorrelation; Standard Error of Estimate indicates model fit; p-value refers to overall model significance; N = sample size.

In Table 3, the overall regression model predicting equitable participation demonstrated a strong fit, with an R^2 of 0.54 and an adjusted R^2 of 0.53, indicating that 53–54% of the variance in equitable participation is explained by the predictors included. The F-test was highly significant ($F(7,792) = 81.97$, $p < .001$), confirming the model’s overall predictive validity. The Durbin-Watson statistic was 1.91, close to the ideal value of 2, suggesting that residuals are independent and no serious autocorrelation is present. The standard error of estimate was 0.48, reflecting reasonable model accuracy. The sample size of 800 provides strong statistical power for these analyses.

Table 4: Multiple Regression Results: Predicting Confidence in Legitimacy and Fairness of Online Assessments

Predictor	B	SE B	B	t	p	Tol.	VIF	95% CI (Lower, Upper)
Digital Literacy	0.41	0.05	0.52	8.20	<.001	0.74	1.35	(0.32, 0.50)
Trust in Online Systems	0.29	0.06	0.33	4.83	<.001	0.77	1.30	(0.17, 0.41)
Internet Stability	0.18	0.04	0.21	4.50	<.001	0.81	1.23	(0.10, 0.26)
Experience with Online Exams	0.14	0.05	0.16	2.80	.005	0.82	1.22	(0.04, 0.24)
Perceived Institutional Transparency	0.12	0.04	0.15	3.00	.003	0.78	1.28	(0.04, 0.20)

Note: B = unstandardized regression coefficient; $SE\ B$ = standard error; β = standardized coefficient; t = t-statistic; p = significance; $Tol.$ = tolerance; VIF = variance inflation factor; 95% CI = 95% confidence interval for B ; all predictors significant at $p < .01$ or better.

The multiple regression analysis presented in Table 4 explores how five key predictors collectively and individually influence students' confidence in the fairness and legitimacy of online assessments. All predictors—Digital Literacy, Trust in Online Systems, Internet Stability, Experience with Online Exams, and Perceived Institutional Transparency—were statistically significant ($p < .01$), indicating their strong contributions to shaping students' perceptions of assessment credibility. Digital Literacy emerged as the most influential predictor, with a standardized coefficient (β) of 0.52, unstandardized B of 0.41, $SE\ B = 0.05$, and a t -value of 8.20 ($p < .001$). The 95% confidence interval ranged from 0.32 to 0.50, and multicollinearity was low (Tolerance = 0.74, $VIF = 1.35$). This underscores that students with higher digital proficiency are more confident in online assessments, likely because they are better equipped to navigate and understand digital platforms and systems. Trust in Online Systems was the second strongest predictor ($B = 0.29$, $\beta = 0.33$, $t = 4.83$, $p < .001$), with a 95% CI of [0.17, 0.41], and low multicollinearity (Tolerance = 0.77, $VIF = 1.30$).

This finding suggests that trust in the security and fairness of online platforms significantly boosts student confidence in digital assessments. Internet Stability also had a notable effect ($B = 0.18$, $\beta = 0.21$, $t = 4.50$, $p < .001$), with a confidence interval of [0.10, 0.26], and minimal multicollinearity (Tolerance = 0.81, $VIF = 1.23$). This implies that reliable connectivity supports students' confidence, possibly by reducing stress related to disruptions during assessments. Experience with Online Exams contributed positively ($B = 0.14$, $\beta = 0.16$, $t = 2.80$, $p = .005$, $CI = [0.04, 0.24]$), indicating that prior experience in online test environments fosters familiarity, reduces anxiety, and enhances trust in assessment procedures. Its multicollinearity measures were also acceptable (Tolerance = 0.82, $VIF = 1.22$). Lastly, Perceived Institutional Transparency significantly predicted student confidence ($B = 0.12$, $\beta = 0.15$, $t = 3.00$, $p = .003$, $CI = [0.04, 0.20]$), with Tolerance = 0.78 and $VIF = 1.28$. This suggests that when institutions communicate openly and clearly about assessment practices, students are more likely to trust the results and processes involved.

Table 5: Mediation and Moderation Analysis

Model	Type	X (Pred.)	M Med.	Z Mod.	Y (Out.)	Effect Type	B	SE	β	p	95% CI (LL, UL)	R ² Δ	F	f ² / κ^2	DW
1	Mediation	DL	PT	—	CAL	Indirect (a × b)	0.28	0.06	0.33	< .001**	[0.17, 0.39]	0.09	16.45	κ^2 = .21	1.98
1	Mediation	DL	PT	—	CAL	Direct (c')	0.24	0.05	0.29	< .001**	[0.11, 0.37]	0.15	23.27	—	1.98
2	Mediation	IA	PT	—	CAL	Indirect (a × b)	0.23	0.05	0.31	< .001**	[0.14, 0.33]	0.08	14.82	κ^2 = .17	2.01
2	Mediation	IA	PT	—	CAL	Direct (c')	0.21	0.05	0.27	< .001**	[0.10, 0.32]	0.14	21.55	—	2.01
A	Moderation	DL	—	IS	PT	Interaction (X × Z)	0.09	0.04	0.12	.034**	[0.01, 0.17]	0.02	4.51	f ² = .05	—
B	Moderation	IA	—	IS	PT	Interaction (X × Z)	0.11	0.05	0.14	.028**	[0.01, 0.21]	0.03	5.26	f ² = .06	—

Note: X = predictor; M = mediator; Z = moderator; Y = outcome; B = unstandardized effect; SE = standard error; β = standardized effect; p = significance; 95% CI = 95% confidence interval; R² Δ = change in R²; F = F-statistic for model; f² and κ^2 = effect size measures; DW = Durbin-Watson statistic; significant effects at $p < .05$, $p < .01$, or $p < .001$.

Table 5 presents findings from mediation and moderation analyses examining the roles of Digital Literacy (DL) and Infrastructure Access (IA) in predicting Confidence in Assessment Legitimacy (CAL), with Perceived Trust (PT) as a mediator and Institutional Support (IS) as a moderator. In the first mediation model, DL significantly predicted CAL through PT, with an indirect effect of $B = 0.28$, $SE = 0.06$, $\beta = 0.33$, $p < .001$, and a 95% CI [0.17, 0.39]. The effect size ($\kappa^2 = .21$) was moderate, with an R^2 change of 0.09 and $F = 16.45$. The direct effect of DL on CAL also remained significant ($B = 0.24$, $SE = 0.05$, $\beta = 0.29$, $p < .001$), indicating partial mediation. The model explained 15% of variance in CAL ($R^2 = 0.15$, $F = 23.27$, $DW = 1.98$). In the second model, IA also significantly predicted CAL via PT, with an indirect effect of $B = 0.23$, $SE = 0.05$, $\beta = 0.31$, $p < .001$, and 95% CI [0.14, 0.33]. The effect size was $\kappa^2 = .17$, and R^2 change = 0.08, $F = 14.82$. The direct effect of IA on CAL remained significant ($B = 0.21$, $SE = 0.05$, $\beta = 0.27$, $p < .001$), suggesting partial mediation, with an overall model $R^2 = 0.14$, $F = 21.55$, and $DW = 2.01$. Moderation analyses showed that Institutional Support (IS) strengthened the relationship between DL and PT ($B = 0.09$, $SE = 0.04$, $\beta = 0.12$, $p = .034$, CI [0.01, 0.17], $f^2 = .05$) and between IA and PT ($B = 0.11$, $SE = 0.05$, $\beta = 0.14$, $p = .028$, CI [0.01, 0.21], $f^2 = .06$). R^2 changes were 0.02 and 0.03 respectively, with corresponding F-statistics of 4.51 and 5.26. In summary, both PT and IS play critical roles in linking digital and infrastructural resources to trust and confidence in assessment systems. The findings highlight the need for enhancing digital literacy, expanding infrastructure access, and strengthening institutional support to improve perceptions of assessment legitimacy.

4.0 DISCUSSION

The study provides a comprehensive analysis of factors influencing equitable participation and confidence in online assessments within digitally-mediated learning environments. Drawing from correlational, regression, and mediation-moderation analyses, the results illuminate the critical role of digital access, socio-economic background, institutional support, and individual competencies in shaping online assessment experiences. First, the correlational analysis establishes strong and statistically significant relationships among all core variables, suggesting a systemic interdependence between infrastructural, personal, and institutional factors. Notably, digital infrastructure access, digital literacy, and trust in online systems emerged as central variables positively associated with both equitable participation and student confidence in online credentials. These findings echo earlier work by Ng (2012) and van Deursen and van Dijk (2014), who argued that digital literacy and access are foundational enablers of meaningful participation in digital learning environments. The positive relationship between digital literacy and confidence in online assessments further aligns with Kim and Frick (2011), who emphasized that students with high digital competence tend to perceive online assessments as more reliable and legitimate. The multiple regression results for equitable participation confirm the unique contributions of household income, urban location, digital infrastructure, and literacy, along with institutional support and instructor feedback quality. These findings indicate that digital divides are not merely

about access to devices or the internet but are deeply intertwined with socio-economic stratification. Students from higher-income households and urban areas have greater chances of participating equitably in online assessments, highlighting a persistent digital inequality reported by Warschauer (2003) and later expanded by Selwyn (2010). Institutional support for e-learning also showed significant predictive power, reinforcing the argument by Almaiah et al. (2020) that students' engagement and performance in online systems depend heavily on institutional readiness, training, and infrastructural robustness.

In addition, internet stability significantly predicted both equitable participation and students' confidence in online credentials. This underscores the infrastructural challenges many educational systems in developing contexts face, a theme consistently echoed in studies such as Boateng et al. (2020) and Adarkwah (2021). These infrastructural limitations can erode trust in the fairness and reliability of online assessments, particularly where intermittent connectivity disrupts students' ability to complete timed or high-stakes tasks. When predicting confidence in the legitimacy and fairness of online assessments, digital literacy again proved to be the strongest predictor, closely followed by trust in online systems. This supports the conceptual framework proposed by Tsai and Chuang (2015), who suggested that students' confidence in e-assessment tools is mediated by their ability to competently navigate digital platforms and their perception of those platforms' integrity. Institutional transparency and prior experience with online exams also significantly contributed to building students' confidence, aligning with Roddy et al. (2017), who found that exposure and repeated interaction with well-designed online systems improved learners' perceptions of fairness, reliability, and academic integrity.

The model summaries further highlight the robustness of the regression models. The model predicting equitable participation accounted for 53% of the variance, and the one predicting confidence in online assessment fairness explained 46%, indicating moderately strong predictive models with real-world relevance. The Durbin-Watson statistics near 2 in both models suggest no serious issues of autocorrelation in the residuals, and the VIF and tolerance values rule out significant multicollinearity. Perhaps the most nuanced insights emerged from the mediation and moderation analyses. The mediating role of perceived trust in online systems in the relationship between both digital literacy and digital infrastructure on one hand, and confidence in assessment legitimacy on the other, reveals that trust acts as a psychological filter or mechanism through which digital resources are internalized by learners. This is in line with Gefen et al. (2003) and Akanbi (2024), who argued that in online systems, trust functions as a central mechanism facilitating user acceptance and satisfaction. The presence of significant direct and indirect effects indicates partial mediation, suggesting that while trust plays a key role, other mechanisms may also contribute to the relationship. The moderation findings are also important: institutional support positively moderated the relationship between both digital literacy and infrastructure and perceived trust. This implies that digital competence and access alone are not sufficient unless supported by proactive institutional strategies, such as clear communication, reliable technical support, and

transparent assessment protocols. This aligns with the findings of Salmon (2005) and Means et al. (2014), who emphasized the institutional context as a catalyst for effective digital education. Even digitally literate students might lack trust in online assessments if institutions fail to communicate processes clearly or address technical and academic concerns promptly. Taken together, the results reveal a multilayered ecosystem where equitable participation and student confidence in online assessment legitimacy are not only a matter of individual capability but are co-constructed through socio-economic privilege, digital readiness, institutional practices, and psychological trust. The findings advocate for a holistic approach to digital education policy one that addresses infrastructural disparities, enhances digital skill development, and reinforces institutional commitment to transparency and support.

4.1 Recommendations

In light of the findings, several strategic recommendations are proposed to enhance digital equity, trust, and assessment integrity within Ghana's higher education system, particularly as institutions deepen their engagement with transnational education frameworks. First, higher education institutions must prioritize the expansion and equitable distribution of digital infrastructure. This includes ensuring reliable internet connectivity, access to digital devices, and the establishment of on-campus digital hubs that cater to underserved student populations. Partnerships between universities, government, and private-sector actors such as telecom providers are essential to closing the persistent digital divide that undermines student participation in online assessments. Secondly, comprehensive digital literacy programmes should be integrated into university curricula across all disciplines. The findings revealed digital literacy as a powerful predictor of both equitable participation and trust in online credentialing. Therefore, structured training on digital communication, assessment navigation, academic integrity in online spaces, and digital self-regulation must become institutional priorities. These programmes should be inclusive, contextually relevant, and responsive to the diverse learning needs of Ghanaian students. Moreover, efforts to build digital trust must extend beyond technology into institutional culture and governance. Universities should establish transparent policies regarding data privacy, online exam protocols, and credentialing standards. Students' perceptions of fairness and legitimacy can be significantly improved through open communication, clear grievance redress mechanisms, and visible instructor involvement in online assessment oversight.

Instructor training on ethical assessment design and digital feedback delivery is equally critical. In addition, the role of institutional support systems must be reimagined as holistic enablers of digital equity. Academic advising, online counseling services, and assessment orientation workshops must be integrated into the digital learning experience. Institutional support was found to moderate the relationship between access/literacy and trust indicating that even digitally competent students may falter in low-support environments. Therefore, building a strong digital support infrastructure is vital to sustaining engagement and retention. Furthermore, policy frameworks guiding transnational education initiatives in Ghana must be recalibrated to include equity and contextual fit as central tenets. Regulators such as the Ghana Tertiary Education Commission (GTEC) should

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develop accreditation standards for online assessment and credentialing that reflect local realities, while ensuring global recognition. Transnational partnerships must also be required to co-develop culturally responsive and digitally inclusive curricula rather than exporting unadapted models. Finally, longitudinal research and impact monitoring should be institutionalized to evaluate the long-term effects of digital interventions on assessment equity, credential legitimacy, and student success. Data-driven decision-making will allow institutions to continuously refine their digital assessment strategies and respond proactively to emergent barriers faced by students. Collectively, these recommendations call for a paradigm shift from technological adoption to human-centered digital transformation. In Ghana's transition toward hybrid and transnational education models, the emphasis must be placed not only on digitizing assessments but also on building inclusive systems of trust, participation, and fairness.

4.2 Limitations of the Study

Despite the robustness of the statistical analyses and the relatively large sample size, this study is not without limitations. First, the reliance on self-reported data introduces potential biases such as social desirability bias and recall bias. Respondents may have overstated their levels of digital literacy, trust in online systems, or equitable participation to align with perceived societal expectations. Moreover, the cross-sectional nature of the data limits the ability to draw causal inferences between variables. While significant associations and predictive relationships were identified, these do not establish temporal precedence or causality. Future longitudinal studies would be better positioned to uncover changes in online assessment behaviours and attitudes over time. Second, the study was conducted within a specific sociocultural and educational context, potentially limiting the generalizability of findings to other regions or countries with different digital infrastructures, educational policies, or socio-economic dynamics. Additionally, while the regression models accounted for several key predictors, other potentially influential variables—such as institutional culture, instructor digital competence, or students' prior academic performance were not included. This exclusion may leave out important nuances in understanding students' equitable participation and confidence in online assessments. Expanding the model to include these factors in future research could yield more comprehensive insights into the complexities of digital assessment equity.

4.3 Conclusion

This study provides compelling empirical evidence on how digital trust and systemic equity shape the evolving landscape of online assessment and credentialing in Ghanaian higher education, particularly within the transnational education context. The results illustrate that digital equity encompassing access to infrastructure, socio-economic inclusion, and digital competencies remains a decisive factor in enabling or hindering students' meaningful participation in online assessment ecosystems. Within this context, digital infrastructure and digital literacy emerge not merely as technological affordances but as equity enablers that significantly determine student access, engagement, and perceived fairness in online assessments. Together, these factors significantly predict both equitable participation and students' confidence in the legitimacy of their

digital credentials. A central contribution of this study lies in uncovering the mediating role of digital trust, particularly trust in online systems and perceived institutional transparency. In the Ghanaian context, where skepticism about online credentialing persists particularly in global mobility and labour market validation building this trust becomes not only a pedagogical concern but a strategic policy imperative. Furthermore, institutional support for digital learning significantly moderates the relationship between digital capacity and trust in online systems, suggesting that even students with access and skills may lose confidence without transparent, responsive, and pedagogically supportive institutional environments. This underscores the importance of a whole-system approach, where universities integrate infrastructure development with learner-centered assessment designs and culturally responsive communication strategies. Crucially, the study offers a nuanced understanding of transnational education challenges in Ghana, where online assessment platforms and credentialing systems are often imported from Western institutional models. Without adaptation to local digital realities and cultural expectations, these systems risk perpetuating rather than mitigating educational inequities. As such, the study calls for a rethinking of online assessment and credentialing practices that align with Ghana's socio-digital context, leveraging localized trust-building mechanisms, inclusive infrastructure strategies, and transparent institutional practices. In sum, this research reinforces the notion that equitable participation in digital education requires more than access it requires trust, support, and systemic alignment. As Ghanaian higher education institutions navigate the terrain of transnational education, building a digitally just ecosystem must be prioritized to ensure that online assessment and credentialing are not only efficient but inclusive, credible, and globally portable.

DECLARATION

Data Availability

The datasets generated and analysed during the current study are not publicly available due to institutional data protection policies and the sensitive nature of individual-level information on students' digital access, performance, and perceptions. However, de-identified and anonymized data may be made available upon reasonable request from the corresponding author, subject to approval by the University of Education, Winneba (UEW) Ethics Committee and adherence to Ghana Education Service (GES) data use protocols. Requests will be assessed based on ethical, legal, and academic integrity standards.

Conflicts of Interest

The author declares no conflict of interest related to the conception, execution, analysis, or publication of this study. No external commercial, institutional, or personal influences affected the research process.

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Ethics Statement

This research adhered to the ethical standards set by the University of Education, Winneba, and complied with global best practices for research involving human participants. All data were stored securely, anonymized during analysis, and used solely for academic purposes. Special care was taken to ensure digital equity, inclusivity, and respect for participant rights, in alignment with Sustainable Development Goal 4 (inclusive and equitable quality education for all).

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