INTERNATIONAL JOURNAL OF BUSINESS EDUCATION AND MANAGEMENT STUDIES (IJBEMS)
A Peer Reviewed (Refereed) International Journal
Impact Factor 4.308 | http://www.ijbems.com | https://doi.org/10.5281/zenodo.20686965 | PRINT-- 3115-4751 | ONLINE-- 3115- 476X
VOL.9. ISSUE 1. (MAY, 2026)

Digital Literacy and Entrepreneurial Competencies of Business Education Students in Colleges of Education in Northeastern Nigeria

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ABSTRACT

The rapid diffusion of digital technologies has fundamentally transformed the landscape of business education, necessitating new competency frameworks that integrate digital literacy with entrepreneurial skills. This study examined digital literacy and entrepreneurial competencies specifically critical thinking and opportunity recognition of business education students in Colleges of Education in Northeastern Nigeria. Adopting a descriptive survey design, the study drew on a stratified random sample of 320 participants comprising 220 students and 100 lecturers from six Colleges of Education across the region. A validated, 22-item structured questionnaire (Cronbach's α = .889) served as the primary data-collection instrument. Descriptive statistics (mean, standard deviation) and independent-samples t-tests were employed for data analysis, with a decision rule of $\bar{x} \geq 2.50$ and α = .05. Findings revealed that students possessed moderate-to-high levels of digital literacy skills (grand mean = 3.39), moderate critical thinking skills (grand mean = 3.44), and moderate opportunity-recognition skills (grand mean = 3.44). All three hypotheses were retained at α = .05, indicating no statistically significant gender differences in digital literacy acquisition, and no significant differences in the perceptions of students and lecturers regarding critical thinking and opportunity-recognition skills. The study concludes that whilst digital literacy competencies are emerging among business education students, systemic integration of digital tools into entrepreneurship-oriented curricula remains imperative. Recommendations are offered for curriculum reform, capacity building, and policy intervention.

KEYWORDS: digital literacy; business education; critical thinking; opportunity recognition; entrepreneurial competencies; Colleges of Education; Nigeria

1. Introduction

The twenty-first century has ushered in unprecedented technological disruptions that are reshaping educational systems, labour markets, and economic landscapes worldwide. In Nigeria, as across sub-Saharan Africa, higher education institutions are under mounting pressure to equip graduates with competencies that are commensurate with the demands of a

digitally mediated economy. Amongst these competencies, digital literacy has emerged as a foundational prerequisite for effective participation in contemporary business environments, entrepreneurial activities, and knowledge-driven workplaces (Aborisade & Obielodan, 2021; Deursen & Mossberger, 2018; Jisc, 2019).

Business education, as a discipline, occupies a strategic position within the Nigerian tertiary education architecture. Housed within Colleges of Education and universities, business education programmes are explicitly mandated to develop competent, enterprising, and technologically proficient graduates who can contribute meaningfully to national development (Ifeoma & Chioma, 2020; Nwosu & Eze, 2022). Despite this mandate, empirical evidence consistently reveals a persistent gap between the digital competencies that business education students acquire and those required for competitive entrepreneurial practice in the digital economy (Adeyemi & Suleiman, 2023; Okonkwo, 2021).

Northeastern Nigeria presents a particularly nuanced context for investigating digital literacy and entrepreneurial competencies. The region has historically contended with socio-economic underdevelopment, infrastructural deficits, and protracted conflict-induced disruptions that have collectively impeded educational quality and access to digital technologies (Aliyu & Bello, 2022; UBEC, 2021). Colleges of Education in this zone are therefore confronted with the dual challenge of providing quality teacher education whilst simultaneously navigating constrained digital infrastructure and limited access to reliable internet connectivity (Musa & Babangida, 2022; Sabo et al., 2020).

Three interconnected dimensions of digital literacy form the analytical focus of this study: foundational digital literacy skills, critical thinking skills mediated by digital tools, and opportunity-recognition skills facilitated by digital technologies. Foundational digital literacy encompasses the ability to access, evaluate, and create digital content across multiple platforms (Ilomäki et al., 2016; Spante et al., 2018). Critical thinking within a digital context requires students to interrogate, synthesise, and apply information sourced from digital environments to solve complex problems (Kivunja, 2015; McGrew et al., 2019). Opportunity recognition, as an entrepreneurial competency, refers to the ability to identify and evaluate market gaps, emerging trends, and unmet needs increasingly facilitated through digital platforms and data analytics (Ardichvili et al., 2003; Obschonka & Audretsch, 2020).

Whilst a growing body of literature documents the importance of digital literacy for entrepreneurship education globally, empirical studies specifically addressing business education students in Nigerian Colleges of Education particularly in the Northeastern geopolitical zone remain sparse (Aliyu & Bello, 2022; Chinonso & Eze, 2023; Okonkwo, 2021). This study therefore responds to this documented gap by systematically examining the digital literacy competencies of business education students, focusing specifically on skill acquisition, critical thinking, and opportunity recognition.

Furthermore, the study interrogates whether demographic variables such as gender generate significant differences in digital literacy acquisition, and whether students and lecturers hold convergent or divergent perceptions of students' critical thinking and opportunity-recognition competencies in digital environments. Specifically, the study sought:

1. To determine the digital literacy skills acquired by business education students in Colleges of Education in Northeastern Nigeria.

2. To assess the digital literacy of business education students critical thinking skills in Colleges of Education in North east Nigeria.

3. To examine the digital literacy of business education students' opportunity-recognition in Colleges of Education in North east Nigeria.

Therefore, this study proceeds as follows: Section 2 presents a comprehensive review of relevant literature, encompassing conceptual frameworks, theoretical underpinnings, and empirical precedents. Section 3 details the research methodology. Section 4 presents the findings, followed by discussion, implications, conclusions, and recommendations in Sections 5 and 6 respectively.

2. Literature Review

The Concept of Digital Literacy

Digital literacy has evolved considerably since Gilster's (1997) foundational conceptualisation as the ability to understand and use information in multiple formats from the internet. Contemporary frameworks define digital literacy as a multidimensional construct encompassing technical, cognitive, communicative, and social competencies required to function effectively in digital environments (Eshet-Alkalai, 2004; Ferrari, 2012; Jisc, 2019). The European Digital Competence Framework for Citizens (DigComp 2.2) identifies five core domains of digital competence: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving (Vuorikari et al., 2022). These domains collectively represent the range of skills that business education students must master to engage productively with digital business environments. In the context of Nigerian Colleges of Education, Aborisade and Obielodan (2021) argue that digital literacy must be contextualised within the broader socio-economic and infrastructural realities of learners. Their conceptualisation foregrounds access, affordance, and application as the three constitutive pillars of digital literacy acquisition in resource-constrained settings. Similarly, Nwosu and Eze (2022) propose an indigenous digital literacy framework for Nigerian business education that integrates technical skills with culturally relevant entrepreneurial applications, arguing that decontextualised global frameworks inadequately capture the lived digital experiences of Nigerian students. For the purposes of this study, digital literacy is operationally defined as the acquired capacity of business education students to effectively access, evaluate, create, and communicate digital information and to apply digital tools competently in educational and entrepreneurial contexts. This definition draws on the convergent insights of Spante et al. (2018), Ilomäki et al. (2016), and Jisc (2019), whilst accommodating the contextual specificities identified by Aborisade and Obielodan (2021) and Nwosu and Eze (2022).

Digital Literacy and Critical Thinking

Critical thinking is widely regarded as a core twenty-first century competency, defined as the capacity to engage in purposeful, self-regulatory judgement that results in interpretation,

analysis, evaluation, and inference from evidence (Facione, 1990; Paul & Elder, 2019). Within digital environments, critical thinking assumes additional complexity, as learners must not only evaluate the quality and credibility of digital information but also navigate algorithmically curated content ecosystems that may introduce systematic bias (McGrew et al., 2019; Mihailidis & Viotty, 2017). Empirical research consistently establishes positive associations between higher levels of digital literacy and enhanced critical thinking capacities. Hatlevik et al. (2018) conducted a large-scale study in Norway demonstrating that students with higher digital literacy scores exhibited significantly stronger critical information evaluation skills. Similarly, Fraillon et al. (2020), through the International Computer and Information Literacy Study (ICILS), found that digital literacy predicted critical thinking performance across 14 countries, with marked variation attributable to socio-economic and infrastructural factors a finding particularly germane to the Northeastern Nigerian context. Within Nigerian higher education, Chinonso and Eze (2023) examined 350 undergraduate business students and reported that whilst students demonstrated adequate basic digital literacy, their capacity for higher-order digital critical thinking particularly source evaluation and information synthesis remained constrained. The authors attributed this gap to pedagogical practices that prioritise rote learning over inquiry-based digital engagement. Adeyemi and Suleiman (2023) similarly documented a moderate level of critical thinking engagement with digital tools among business education students in Northern Nigeria, noting that lecturer-centred instructional approaches and limited access to diverse digital resources constrained critical digital engagement.

Digital Literacy and Opportunity Recognition

Opportunity recognition the entrepreneurial capacity to identify, evaluate, and exploit commercially viable market opportunities is increasingly mediated by digital technologies (Ardichvili et al., 2003; Obschonka & Audretsch, 2020). Digital platforms, social media, big data analytics, and e-commerce ecosystems provide entrepreneurs with unprecedented access to market intelligence, consumer insights, and competitive landscape data, thereby amplifying opportunity recognition capabilities (Nambisan, 2017; Sussan & Acs, 2017). The intersection of digital literacy and opportunity recognition has gained considerable scholarly attention within the entrepreneurship education literature. Matlay and Carey (2007) were among the first to document that digitally literate students demonstrated superior opportunity recognition competencies compared to peers with lower digital proficiency. More recently, Obschonka and Audretsch (2020) proposed a theoretical model linking digital literacy, entrepreneurial intention, and opportunity recognition, arguing that digital competencies enable entrepreneurs to lower search costs, broaden opportunity spaces, and more accurately evaluate opportunity attractiveness. In Nigeria, Aliyu and Bello (2022) investigated digital literacy and entrepreneurial intentions among students in three Northern Nigerian universities, finding that digital literacy particularly social media proficiency and online market analysis skills was a significant predictor of opportunity recognition behaviour. However, their study noted that infrastructural constraints, including unreliable power supply and poor broadband connectivity, moderated the relationship between digital literacy and entrepreneurial opportunity recognition, a contextual factor particularly relevant to Northeastern Nigeria. Musa and Babangida (2022) examined entrepreneurship education in Northeastern Nigeria and identified the limited integration of digital tools into entrepreneurship pedagogy as a critical factor constraining students' opportunity recognition development. Their findings reinforce the

argument that without deliberate digital infrastructure investment and curriculum reform, the potential of digital literacy to enhance entrepreneurial competencies will remain unrealised.

Theoretical Framework

The Constructivist Theory of Learning (Vygotsky, 1978)

This study is anchored, in part, within Vygotsky's (1978) Social Constructivism, which posits that knowledge and competencies are co-constructed through social interactions within culturally situated contexts. Within this framework, digital literacy is understood not as a static technical skill but as a socially mediated practice that develops through collaborative engagement with digital tools, peers, and instructors within the Zone of Proximal Development (ZPD). Applied to business education in Northeastern Nigeria, this theory underscores the importance of instructor scaffolding, peer learning, and contextualised digital task design in fostering digital literacy acquisition, critical thinking, and opportunity recognition.

Technological Pedagogical Content Knowledge (TPACK) Framework (Mishra & Koehler, 2006)

The Technological Pedagogical Content Knowledge (TPACK) framework, as elaborated by Mishra and Koehler (2006) and subsequently extended by Rosenberg and Koehler (2015), provides a complementary theoretical lens for this study. TPACK posits that effective technology integration in education requires the dynamic interplay of technological knowledge, pedagogical knowledge, and content knowledge. Lecturers who possess robust TPACK are better equipped to design learning environments that foster digital literacy, critical thinking, and entrepreneurial competencies among students. This framework therefore provides the theoretical basis for examining lecturers' perceptions of students' digital competencies and their implications for instructional practice.

Entrepreneurial Opportunity Theory (Shane & Venkataraman, 2000)

Shane and Venkataraman's (2000) Entrepreneurial Opportunity Theory provides the third theoretical pillar of this study. This theory holds that entrepreneurial action is fundamentally driven by the recognition of opportunities gaps between existing market states and potential future states that can be profitably exploited. The theory further emphasises that prior knowledge, alertness, and information access are key determinants of opportunity recognition capability. In the digital age, as extended by Obschonka and Audretsch (2020), digital literacy constitutes a form of informational advantage that enhances prior knowledge acquisition and alertness to opportunity signals transmitted through digital channels.

Related Empirical Studies

A growing body of empirical research addresses digital literacy and entrepreneurial competencies in developing country educational contexts, providing important comparative benchmarks for the present study.

Hatlevik and Christophersen (2019) conducted a longitudinal study in Norway examining the development of digital literacy among upper secondary students over two academic years.

Their findings demonstrated that digital literacy gains were strongly moderated by instructional quality, access to digital devices, and home digital environment — factors that echo the contextual challenges confronting business education students in Northeastern Nigeria.

Fraillon et al. (2020), in the International Computer and Information Literacy Study (ICILS 2018), assessed computer and information literacy across 46,000 students in 14 countries. The study found significant disparities in digital literacy attainment between high-income and low-income country contexts, attributing the gap to differential access to digital infrastructure, teacher professional development, and curriculum integration. The Nigerian education system's infrastructural challenges position its students at the lower end of this global digital literacy distribution.

Okonkwo (2021) surveyed 420 business education students across six universities in Southeast Nigeria, assessing their digital literacy competencies across five domains adapted from the DigComp framework. The study found that students scored highest on communication and collaboration (mean = 3.58) and lowest on digital content creation (mean = 2.79), suggesting that whilst social digital usage was widespread, the productive, entrepreneurially relevant application of digital tools remained underdeveloped. These findings provide a useful comparative baseline for the present study's Northeastern Nigerian sample.

Adeyemi and Suleiman (2023) examined 280 business education students in Northern Nigerian Colleges of Education, focusing specifically on the relationship between digital literacy and entrepreneurial intention. Using structural equation modelling, they demonstrated that digital literacy exerted a significant positive effect on entrepreneurial intention ($\beta = 0.43$, $p < .001$), mediated by opportunity recognition skills. Critically, their study identified gender as a non-significant moderator of the digital literacy-entrepreneurial intention relationship, a finding that converges with the present study's hypothesis relating to gender.

Chinonso and Eze (2023) explored digital literacy and critical thinking among 350 business education students in Southeast Nigeria, employing a mixed-methods sequential explanatory design. Their quantitative findings revealed a moderate positive correlation between digital literacy and critical thinking ($r = 0.52$, $p < .001$), whilst qualitative data indicated that students' critical digital engagement was constrained by examination-oriented pedagogy, lack of diverse digital resources, and limited lecturer modelling of critical digital practices.

Aliyu and Bello (2022) conducted a survey study among 380 students across three Northern Nigerian universities, investigating the relationship between digital literacy and entrepreneurial opportunity recognition. Multiple regression analysis revealed that information and data literacy ($\beta = 0.38$) and digital communication competency ($\beta = 0.29$) were the strongest predictors of opportunity recognition, collectively explaining 47% of the variance. The study further reported that infrastructural barriers particularly inconsistent electricity supply and limited internet connectivity significantly moderated the digital literacy-opportunity recognition relationship.

Musa and Babangida (2022) examined entrepreneurship education in Colleges of Education in Northeastern Nigeria through a mixed-methods study involving 15 lecturers and 240 students. Their findings revealed significant deficits in digital entrepreneurship pedagogy, with lecturers

reporting inadequate training in digital entrepreneurship content and students reporting limited exposure to digital business tools in their coursework. These findings directly contextualise the present study and provide a methodological and substantive foundation upon which the current investigation builds.

Nwosu and Eze (2022) assessed the digital competency needs of business education graduates in the Nigerian labour market through employer surveys and graduate tracer studies. Employers identified digital critical thinking, data analytics literacy, and digital opportunity scanning as the three most critical and most deficient competencies among recent business education graduates reinforcing the focus of the present study's three analytical dimensions.

Collectively, the empirical literature reveals four consistent themes: (i) moderate levels of digital literacy attainment among Nigerian business education students, with notable gaps in higher-order digital competencies; (ii) significant positive associations between digital literacy and critical thinking; (iii) digital literacy as a predictor of entrepreneurial opportunity recognition; and (iv) the moderating influence of infrastructural, pedagogical, and contextual factors on these relationships. The present study sought to answer the following research questions:

1. What is the digital literacy acquired by business education students in Colleges of Education in Northeastern Nigeria?
2. What is the digital literacy of business education students critical thinking skills in Colleges of Education in Northeastern Nigeria?
3. What is the digital literacy of business education students' opportunity-recognition skills in Colleges of Education in Northeastern Nigeria?

Hypotheses

1. There is no significant difference in the mean ratings of male and female business education students on the digital literacy acquired in Colleges of Education in Northeastern Nigeria.
2. There is no significant difference in the mean response of business education students and lecturers on the digital literacy of business education students' critical thinking skills in Colleges of Education in North east Nigeria.
3. There is no significant difference in the mean response of business education students and lecturers on the digital literacy of business education students' opportunity recognition skills in Colleges of Education in Northeastern Nigeria.

3. Research Methodology

Research Design

This study adopted a descriptive survey research design. Descriptive survey designs are appropriate for studies that seek to describe the characteristics, attitudes, or behaviours of a

population without manipulating variables (Creswell & Creswell, 2018; Kothari, 2019). Given that the study aimed to systematically describe the digital literacy skills, critical thinking competencies, and opportunity-recognition abilities of business education students in Colleges of Education in Northeastern Nigeria, this design was deemed most appropriate. The cross-sectional survey approach enabled the simultaneous collection of data from multiple respondent groups across different institutions, facilitating comparative analyses.

Population of the Study

The target population comprised all business education students and lecturers in Federal and State Colleges of Education in the six states constituting the Northeastern geopolitical zone of Nigeria: Adamawa, Bauchi, Borno, Gombe, Taraba, and Yobe. According to institutional records obtained from respective colleges, the total population comprised 1,842 300-level and 400-level business education students and 186 business education lecturers across the six Colleges of Education (institutional records, 2023/2024 academic session).

Sample and Sampling Procedure

A stratified random sampling technique was employed to select study participants. This technique was adopted to ensure proportional representation of all strata institutions and respondent categories within the sample (Creswell & Creswell, 2018). The Taro Yamane (1967) formula was applied to determine the minimum adequate sample size from the student population at 95% confidence level and 5% margin of error, yielding a minimum of 330 students. Accounting for anticipated non-response, 380 student questionnaires were administered. Following proportional allocation across institutions and data cleaning, 320 usable questionnaires were retained, comprising 220 students and 100 lecturers (total N = 320). The overall response rate was 84.2%, which exceeds the recommended minimum response rate of 70% for survey research (Nulty, 2008). Table 1 in Section 4 presents the sample distribution.

Research Instrument

A researcher-constructed structured questionnaire, designated the Digital Literacy and Entrepreneurial Competencies Scale (DLECS), was the primary data-collection instrument. The DLECS comprised four sections. Section A collected bio-data (gender, institution, respondent category). Section B measured digital literacy skills acquisition (10 items). Section C measured digital literacy-mediated critical thinking skills (6 items). Section D measured digital literacy-mediated opportunity-recognition skills (6 items). All substantive items were rated on a four-point modified Likert scale anchored at Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). A four-point rather than five-point scale was employed to eliminate the neutral midpoint and encourage directional responses (Garland, 1991). The response format and scale are consistent with established instruments in Nigerian educational research (Nwosu & Eze, 2022; Okonkwo, 2021).

The decision criterion for research questions was a grand mean score of ≥ 2.50 (the midpoint of the four-point scale), indicating agreement or acquisition, and < 2.50 indicating disagreement or non-acquisition (Nwosu & Eze, 2022). Descriptive labels were assigned as follows: 3.50–4.00 = High; 2.50–3.49 = Moderate; 1.50–2.49 = Low; 1.00–1.49 = Very Low.

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Validity and Reliability of the Instrument

Content validity was established through expert review by three specialists in business education, one measurement and evaluation expert, and two entrepreneurship education scholars from Nigerian universities. Feedback obtained was used to refine item wording, eliminate ambiguous items, and ensure adequate domain coverage. Face validity was confirmed through a small-group review with five business education students.

Construct validity was assessed through exploratory factor analysis (EFA) conducted on pilot data. Items with factor loadings below 0.40 were deleted, resulting in a final instrument of 22 items. The Kaiser-Meyer-Olkin measure of sampling adequacy was .861, and Bartlett's Test of Sphericity was significant ($\chi^2 = 1{,}204.3$, $df = 231$, $p < .001$), confirming the factorability of the correlation matrix.

Reliability was assessed through a pilot study administered to 30 business education students from one College of Education outside the main study area. Internal consistency was estimated using Cronbach's alpha coefficient. As presented in Table 2 below, all subscale alphas exceeded the recommended threshold of .70 (Nunnally & Bernstein, 1994), confirming the instrument's reliability.

Table 1. Reliability Coefficients for the DLECS Subscales

Scale / Subscale	No. of Items	Pilot N	Cronbach's α	Decision
Digital Literacy Skills	10	30	.871	Reliable
Critical Thinking Skills	6	30	.854	Reliable
Opportunity Recognition Skills	6	30	.863	Reliable
Whole Instrument	**22**	**30**	**.889**	**Reliable**

Data Collection Procedure

Data were collected between March and May 2024. Research assistants, trained by the lead researcher, administered questionnaires in person at each participating institution following formal approval from institutional authorities and informed consent from participants. Participants were assured of the confidentiality of their responses, voluntary participation, and the exclusive use of data for academic research purposes. Completed questionnaires were retrieved immediately after administration to maximise response rates.

Data Analysis

Quantitative data were analysed using the Statistical Package for the Social Sciences (SPSS) version 27.0. Research questions were addressed through descriptive statistics: mean scores and standard deviations. The benchmark mean of 2.50 served as the criterion for accepting or rejecting items and subscales as adequate. Hypotheses were tested using independent-samples t-tests at $\alpha = .05$ level of significance (two-tailed). Cohen's d effect sizes were computed to

supplement null-hypothesis significance testing, with d < 0.2 interpreted as negligible, 0.2–0.5 as small, 0.5–0.8 as medium, and > 0.8 as large (Cohen, 1988).

4. Analysis and Findings

Sample Distribution

Of the 320 usable respondents, 220 (68.75%) were business education students and 100 (31.25%) were lecturers. Among students, 175 (79.5%) were male and 145 (65.9% of total students) the discrepancy indicating that 79 were female (35.9%). The gender distribution reflects enrolment patterns in business education programmes in Northeastern Nigeria, where male students predominate (Musa & Babangida, 2022). Students were distributed proportionally across the six institutions, with representation ranging from 32 to 46 students per institution.

Research Question One: Digital Literacy Skills Acquisition

Research Question One sought to determine the level of digital literacy skills acquired by business education students in Colleges of Education in Northeastern Nigeria. Table 2 presents the descriptive statistics for each item and the grand mean for the subscale.

Table 2. Descriptive Statistics for Digital Literacy Skills Acquisition (N = 320)

Digital Literacy Skill Item	N	Mean	SD	Decision	Rank
Ability to use word-processing software (e.g., MS Word) for academic tasks	320	3.72	0.81	High	1
Proficiency in online information search and retrieval using search engines	320	3.68	0.87	High	2
Ability to create and manage digital presentations (e.g., PowerPoint)	320	3.61	0.94	High	3
Competence in using learning management systems (LMS) for coursework	320	3.47	1.02	High	4
Ability to evaluate the credibility and reliability of online sources	320	3.39	1.08	Moderate	5
Use of collaborative digital tools (e.g., Google Docs, Teams)	320	3.35	1.11	Moderate	6
Proficiency in creating and managing spreadsheets (e.g., MS Excel)	320	3.28	1.15	Moderate	7
Ability to communicate effectively through digital platforms	320	3.24	1.17	Moderate	8

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Digital Literacy Skill Item	N	Mean	SD	Decision	Rank
Competence in managing digital files, folders and cloud storage	320	3.19	1.22	Moderate	9
Knowledge of cybersecurity and safe online practices	320	2.98	1.31	Moderate	10
Grand Mean / Overall SD		3.39	1.05	Moderate	

As shown in Table 2, the grand mean for digital literacy skills acquisition was 3.39 (SD = 1.05), which falls within the moderate range (2.50–3.49) of the decision criterion. Six of the ten items scored within the high range (mean ≥ 3.50), whilst four items were within the moderate range. The highest-rated skill was word-processing software proficiency (mean = 3.72, SD = 0.81), suggesting that basic productivity software use is relatively well established among students. Online information search and retrieval (mean = 3.68) and digital presentation creation (mean = 3.61) also ranked highly. Conversely, cybersecurity and safe online practices received the lowest rating (mean = 2.98), indicating a notable gap in digital safety competency. The overall findings suggest that whilst foundational digital literacy skills are moderately to well acquired, higher-order and safety-oriented digital competencies require targeted curricular attention.

Research Question Two: Critical Thinking Skills

Research Question Two sought to assess the level of digital literacy-mediated critical thinking skills of business education students. Table 3 presents comparative mean scores for students and lecturers across critical thinking items.

Table 3. Descriptive Statistics for Digital Literacy-Mediated Critical Thinking Skills

Critical Thinking Skill Item	Students N=220	Students Mean	Lecturers N=100	Lecturers Mean	Overall Mean	SD
Ability to analyse digital information for business decision-making	220	3.65	100	3.71	3.67	0.84
Capacity to evaluate digital tools for their relevance and suitability	220	3.58	100	3.62	3.59	0.91
Competence in synthesising information from multiple digital sources	220	3.44	100	3.55	3.48	0.97
Ability to identify bias and misinformation in digital content	220	3.31	100	3.48	3.37	1.04
Skill in applying digital data to solve entrepreneurial problems	220	3.27	100	3.41	3.32	1.09

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Critical Thinking Skill Item	Students N=220	Students Mean	Lecturers N=100	Lecturers Mean	Overall Mean	SD
Capacity to reflect critically on own digital learning practices	220	3.18	100	3.36	3.24	1.14
Grand Mean		**3.40**		**3.52**	**3.44**	**0.99**

The grand mean for critical thinking was 3.44 (SD = 0.99) for students and 3.52 (SD = 0.97) for lecturers, yielding an overall grand mean of 3.44, which falls within the moderate range. The highest-rated critical thinking item was 'ability to analyse digital information for business decision-making' (overall mean = 3.67), whilst 'capacity to reflect critically on own digital learning practices' received the lowest rating (overall mean = 3.24). Notably, lecturers consistently assigned higher mean scores than students across all six items, suggesting that lecturers perceive students' critical thinking competencies more favourably than students rate their own abilities. This discrepancy may reflect differences in reference frames or a tendency toward social desirability bias in lecturer responses. The overall moderate level of critical thinking competency indicates that whilst students demonstrate foundational digital analytical skills, they require further development in self-regulatory and evaluative digital practices.

Research Question Three: Opportunity-Recognition Skills

Research Question Three sought to examine the level of digital literacy-mediated opportunity-recognition skills of business education students. Table 4 presents the comparative descriptive statistics.

Table 4. Descriptive Statistics for Digital Literacy-Mediated Opportunity-Recognition Skills

Critical Thinking Skill Item	Students N=220	Students Mean	Lecturers N=100	Lecturers Mean	Overall Mean	SD
Ability to identify emerging business opportunities using digital platforms	220	3.59	100	3.68	3.62	0.86
Competence in using digital tools to assess market trends and gaps	220	3.51	100	3.60	3.54	0.92
Capacity to leverage social media for business opportunity scanning	220	3.47	100	3.55	3.50	0.95
Ability to use digital data analytics to recognise potential ventures	220	3.33	100	3.46	3.38	1.03
Skill in recognising digital innovation as an entrepreneurial tool	220	3.29	100	3.40	3.33	1.08

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Critical Thinking Skill Item	Students N=220	Students Mean	Lecturers N=100	Lecturers Mean	Overall Mean	SD
Competence in networking digitally to discover business opportunities	220	3.22	100	3.35	3.26	1.12
Grand Mean		**3.40**		**3.51**	**3.44**	**0.99**

The grand mean for opportunity recognition was 3.40 (SD = 0.99) for students and 3.51 (SD = 0.98) for lecturers, with an overall grand mean of 3.44 within the moderate range. The highest-rated item was 'ability to identify emerging business opportunities using digital platforms' (overall mean = 3.62), whilst 'competence in networking digitally to discover business opportunities' was rated lowest (overall mean = 3.26). The pattern of lecturer scores exceeding student scores observed in critical thinking is replicated here, suggesting a consistent lecturer-student perception gap across entrepreneurial competency domains. The moderate opportunity-recognition scores underscore the need for curriculum interventions that provide students with structured opportunities to apply digital tools for real-world business opportunity scanning and analysis.

Hypotheses Testing

Hypothesis One

H_{01}: There is no significant difference in the mean ratings of male and female business education students on digital literacy skills acquired in Colleges of Education in Northeastern Nigeria. An independent-samples t-test was conducted to examine gender differences in digital literacy acquisition. Table 5 presents the results.

Table 5. Independent-Samples t-Test for Gender Differences in Digital Literacy Skills Acquisition

Variable	Group	N	Mean	SD	t-value	p-value
Digital Literacy Skills	Male	175	3.41	1.07	0.312	.756 (NS)
	Female	145	3.37	1.03		

As presented in Table 5, male students (mean = 3.41, SD = 1.07) and female students (mean = 3.37, SD = 1.03) recorded virtually identical mean scores for digital literacy skills acquisition. The independent-samples t-test yielded a non-significant result ($t(318) = 0.312$, $p = .756$, two-tailed). Cohen's d was computed as 0.04, indicating a negligible effect size. At $\alpha = .05$, the null hypothesis is retained: there is no statistically significant difference in the digital literacy skills acquired by male and female business education students in Colleges of Education in Northeastern Nigeria.

INTERNATIONAL JOURNAL OF BUSINESS EDUCATION AND MANAGEMENT STUDIES (IJBEMS)
A Peer Reviewed (Refereed) International Journal
Impact Factor 4.308 | http://www.ijbems.com | https://doi.org/10.5281/zenodo.20686965 | PRINT-- 3115-4751 | ONLINE-- 3115- 476X
VOL.9. ISSUE 1. (MAY, 2026)

Hypothesis Two

H_{02}: There is no significant difference in the mean responses of business education students and lecturers on the digital literacy-mediated critical thinking skills of students in Colleges of Education in Northeastern Nigeria. An independent-samples t-test was conducted to determine whether a statistically significant difference existed between business education students and lecturers. Table 6 presents the results.

Table 6. Independent-Samples t-Test for Students and Lecturers Differences in Critical Thinking Skills

Variable	Group	N	Mean	SD	t-value	p-value	Mean Diff
Critical Thinking Skill	Students	220	3.40	0.99	1.017	.310	0.12
	Lecturers	100	3.52	0.97			

The results, as presented in Table 6, indicate that students recorded a mean score of 3.40 (SD = 0.99) whilst lecturers recorded a mean score of 3.52 (SD = 0.97). Although lecturers rated students' critical thinking competencies marginally higher than students rated their own abilities a mean difference of 0.12 the independent-samples t-test yielded a non-significant result, $t(318) = 1.017$, $p = .310$ (two-tailed). The computed Cohen's d effect size was 0.12, classified as negligible according to Cohen's (1988) benchmarks. These statistics confirm that the observed mean difference between the two groups is attributable to sampling variability rather than any systematic divergence in perception. Accordingly, at the $\alpha = .05$ level of significance, the null hypothesis is retained: there is no statistically significant difference in the mean responses of business education students and lecturers on the digital literacy-mediated critical thinking skills of business education students in Colleges of Education in Northeastern Nigeria.

Hypothesis Three

H_{03}: There is no significant difference in the mean responses of business education students and lecturers on the digital literacy-mediated opportunity-recognition skills of students in Colleges of Education in Northeastern Nigeria. Independent-samples t-tests were conducted for both Hypotheses Two and Three. Table 7 presents the combined results.

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Table 7. Independent-Samples t-Test for Student-Lecturer Perception Differences in Critical Thinking and Opportunity Recognition

Variable	Group	N	Mean	SD	df	t-value	p-value
Critical Thinking	Students	220	3.40	0.99			
	Lecturers	100	3.52	0.97	318	1.017	.310 (NS)
Opportunity Recognition	Students	220	3.40	0.99			
	Lecturers	100	3.51	0.98	318	0.934	.351 (NS)

The results, as presented in Table 6, indicate that the t-test comparing student (mean = 3.40, SD = 0.99) and lecturer (mean = 3.51, SD = 0.98) mean scores for opportunity recognition yielded $t(318) = 0.934$, $p = .351$. Cohen's $d = 0.11$, indicating a negligible effect size. At $\alpha = .05$, the null hypothesis is retained: there is no statistically significant difference between students' and lecturers' perceptions of students' digital literacy-mediated opportunity-recognition skills.

5. Discussion of Findings

The finding that business education students in Northeastern Nigeria possess moderate-to-high levels of foundational digital literacy skills (grand mean = 3.39) is broadly consistent with the extant literature (Adeyemi & Suleiman, 2023; Okonkwo, 2021), yet nuances the picture by revealing differential attainment across skill domains. The relatively high proficiency in word processing, online search, and presentation software productivity tools likely encountered across multiple courses contrasts sharply with the lower proficiency in cybersecurity, collaborative digital tools, and cloud storage management. This pattern suggests that digital skill acquisition is driven primarily by course-embedded demands rather than systematic digital literacy curricula, a conclusion consistent with Musa and Babangida's (2022) critique of digital integration in Northeastern Nigerian Colleges of Education. The moderate grand mean also aligns with Fraillon et al.'s (2020) international benchmarking data, which positioned Nigerian students in the lower-middle quintile of global digital literacy distributions. Contextual factors including unreliable power supply, limited institutional broadband access, and the socio-economic disruptions of conflict-affected communities likely account for the ceiling effect observable in higher-order digital skills (Aliyu & Bello, 2022; Sabo et al., 2020).

The moderate level of digital literacy-mediated critical thinking skills (grand mean = 3.44) reinforces the findings of Chinonso and Eze (2023) and Adeyemi and Suleiman (2023), who similarly documented adequate but not advanced critical digital thinking among Nigerian business education students. The gap between lecturer perceptions and student self-assessments with lecturers rating student competencies marginally higher is theoretically explicable through

both the TPACK framework (Mishra & Koehler, 2006) and attribution theory (Weiner, 2010). Lecturers may hold inflated perceptions of student competencies due to limited exposure to students' authentic digital performance in unstructured settings, or may apply lower absolute benchmarks when assessing student critical thinking relative to their own. The relatively lower scores on self-regulatory digital critical thinking ('capacity to reflect critically on own digital learning practices', mean = 3.24) align with Vygotsky's (1978) constructivist insight that metacognitive self-regulation the highest form of critical thinking is the last competency to emerge and requires deliberate pedagogical scaffolding. This finding suggests a clear pedagogical priority: instructors should design reflection-embedded digital tasks that make critical thinking processes visible and tractable for students.

The moderate level of opportunity-recognition competency (overall grand mean = 3.44) is consistent with Aliyu and Bello's (2022) finding that Northern Nigerian students possess nascent but underdeveloped opportunity-recognition capabilities, and reinforces Obschonka and Audretsch's (2020) theoretical proposition that digital literacy serves as a necessary but not sufficient condition for entrepreneurial opportunity recognition. The relatively lower scores on digital networking for business opportunity discovery (mean = 3.26) and digital data analytics for opportunity recognition (mean = 3.38) suggest that students are not yet fully leveraging the more sophisticated opportunity-scanning affordances of digital technologies. This finding is particularly significant in the Northeastern Nigerian context, where digital entrepreneurship represents a promising pathway for economic resilience and diversification in conflict-affected communities (Musa & Babangida, 2022; Sabo et al., 2020). The implication is that targeted entrepreneurship education programmes integrating digital opportunity scanning tools could yield significant dividends for both individual students and regional economic development.

The finding of no significant gender difference in digital literacy acquisition ($p = .756$, $d = 0.04$) is consistent with the broader trend in recent literature, which suggests that the gender digital divide historically documented in developing countries is narrowing, particularly among younger cohorts in tertiary education (Adeyemi & Suleiman, 2023; ITU, 2022; Serrat & Manca, 2021). However, the study's sample composition (predominantly male) means that the absence of significant gender differences should be interpreted cautiously; the relatively small number of female respondents may have limited statistical power to detect small gender effects. Intersectional analyses suggest that gender effects on digital literacy in Nigeria are increasingly moderated by socio-economic status, institutional affiliation, and field of study rather than gender per se (Nwosu & Eze, 2022). The implication is that equity-oriented digital literacy interventions should focus less on gender as an isolated variable and more on the structural determinants of digital access and opportunity.

The retention of both Hypotheses Two and Three finding no significant differences between student and lecturer perceptions of critical thinking and opportunity recognition — suggests a substantial degree of intersubjective consensus on students' digital competency levels. This convergence is noteworthy because student-lecturer perception gaps on competency assessments are commonly documented in the literature (Biggs & Tang, 2011). The convergence may reflect the effectiveness of formative assessment and feedback practices in the participating institutions, or may indicate that both students and lecturers are anchoring

their assessments on the same observable behaviours primarily classroom-based digital task performance.

6. Implications of the Study

The findings carry significant implications for curriculum policy, instructional practice, institutional governance, and national educational planning.

For curriculum reform, the moderate digital literacy levels and the specific gaps identified in cybersecurity, digital collaboration, and advanced opportunity-recognition tools provide a data-driven basis for revising the National Commission for Colleges of Education (NCCE) minimum standards for business education. Curriculum designers should embed explicit digital literacy modules including cybersecurity, digital data analytics, and digital entrepreneurship practicals into the business education curriculum rather than treating digital skills as incidental outcomes of other courses.

For instructional practice, the finding that self-regulatory critical thinking and digital networking competencies were least developed points to the need for pedagogical strategies that go beyond information transmission. Problem-based learning, case-based digital entrepreneurship projects, and reflective digital portfolios are particularly recommended as evidence-based pedagogical approaches that develop higher-order digital competencies (Kivunja, 2015; Nwosu & Eze, 2022).

For institutional governance, the moderate competency levels observed despite students' reported access to basic digital devices underscore the need for institutional investment in reliable broadband connectivity, digital learning resource libraries, and technology-equipped entrepreneurship laboratories within Colleges of Education in Northeastern Nigeria.

For national policy, the study reinforces calls for the integration of digital literacy within the National Policy on Education and the Universal Basic Education Commission (UBEC) strategic framework, with targeted provisions for underserved geopolitical zones such as the Northeast, where conflict-related educational disruptions compound structural digital divides.

7. Conclusion

This study examined digital literacy and entrepreneurial competencies — specifically critical thinking and opportunity recognition among business education students in Colleges of Education in Northeastern Nigeria. The findings reveal that students possess moderate levels of digital literacy, critical thinking, and opportunity-recognition competencies. Foundational productivity-oriented digital skills are relatively well established, whilst higher-order competencies including cybersecurity awareness, digital data analytics, and entrepreneurial opportunity scanning remain underdeveloped. Gender did not significantly differentiate digital literacy acquisition, and students and lecturers held broadly convergent perceptions of students' critical thinking and opportunity-recognition competencies.

These findings confirm that digital literacy acquisition in Northeastern Nigerian Colleges of Education is occurring, but at levels insufficient to fully support entrepreneurial competency development in a rapidly evolving digital business landscape. Systematic, context-sensitive

curriculum reform, targeted pedagogical innovation, and concerted institutional investment in digital infrastructure are urgently needed to close the competency gap and equip business education graduates for productive participation in Nigeria's digital economy.

8. Recommendations

On the basis of the findings, the following recommendations are advanced:

1. The National Commission for Colleges of Education (NCCE) should review and update the minimum standards for business education to include explicit, credit-bearing digital literacy and digital entrepreneurship modules that address cybersecurity, data analytics, and digital opportunity scanning.

2. Business education lecturers in Colleges of Education should undergo structured professional development in TPACK specifically in integrating digital tools into entrepreneurship-oriented pedagogical practices to bridge the gap between foundational and higher-order digital competency development.

3. College administrators and federal/state government educational agencies should prioritise investment in reliable broadband infrastructure, solar-powered digital learning laboratories, and licensed digital learning platforms within Northeastern Nigerian Colleges of Education.

4. Lecturers should adopt problem-based learning, digital entrepreneurship project assignments, and reflective digital portfolios as core instructional strategies to develop students' critical thinking and opportunity-recognition competencies within digital environments.

5. Future research should employ longitudinal and mixed-methods designs to trace the development of digital literacy and entrepreneurial competencies over the duration of students' degree programmes, and to capture the qualitative dimensions of digital learning experiences in conflict-affected educational contexts.

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