

# Information And Communication Technology and Digital Literacy in the 21<sup>st</sup> Century

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***Abstract- In today's knowledge-driven society, Information and Communication Technology (ICT) and digital literacy are essential competencies for individuals and organizations. The 21st century demands not only the ability to access digital tools but also to utilize them effectively for education, communication, governance, and economic development. This study explores the significance of ICT and digital literacy and examines the factors affecting their integration, particularly in developing contexts. The research identifies gaps in access, usage, and skill acquisition and aims to provide solutions for bridging the digital divide. A survey method was employed to gather quantitative data from 150 participants across three educational institutions in Nigeria. Results revealed a positive correlation between digital access and performance, and underscored the need for curriculum reforms, teacher training, and infrastructure development. The study recommends strategic policy initiatives to foster digital inclusion and calls for collaborative action between governments, educators, and technology stakeholders to ensure equitable access and empowerment through ICT.***

***Index Terms- ICT, Digital Literacy, 21st Century, Education, Digital Divide, Skills Development***

## I. INTRODUCTION

In the 21st century, ICT has revolutionized how people live, learn, and work. It encompasses tools that facilitate the storage, retrieval, processing, and

transmission of information through digital means (UNESCO, 2018). Digital literacy refers to the ability to effectively use ICT tools to access, evaluate, and create information, communicate with others, and solve problems in digital environments (American Library Association, 2013). As globalization and technology rapidly shape societal functions, digital literacy has become crucial not only for academic and professional pursuits but also for social and civic participation.

The 21st century has ushered in an era where the integration of Information and Communication Technology (ICT) into everyday life is not just beneficial but indispensable. ICT encompasses technologies that provide access to information through telecommunications, including the internet, wireless networks, smartphones, computers, and other communication mediums (UNESCO, 2018). Digital literacy, on the other hand, refers to the ability to find, evaluate, utilize, share, and create content using digital technologies (Belshaw, 2014). These two concepts are foundational for navigating the complex demands of the contemporary digital society.

As the world becomes increasingly interconnected, the need for individuals to be digitally literate has become paramount. From online learning to digital health services, and from e-commerce to e-governance, ICT has transformed the way societies function. However, there remains a significant digital divide between and within countries, posing a

challenge to inclusive digital transformation (van Dijk, 2020).

The 21st century is characterized by rapid technological transformation, changing the dynamics of how individuals interact, learn, work, and contribute to society. Information and Communication Technology (ICT) has emerged as the backbone of modern life, facilitating access to knowledge, bridging distances, and accelerating global communication. Digital literacy, defined as the ability to effectively use digital tools to locate, evaluate, create, and communicate information, is...

In the context of education, ICT has redefined teaching and learning processes, enabling personalized learning, collaborative tasks, and access to vast digital resources. Yet, despite the global push toward digital integration, many regions, particularly in the Global South, continue to face substantial barriers in ICT access and digital literacy acquisition. These include infrastructural gaps, limited training for educators, socio-economic disparities, and policy limitations.

ICT is a transformative force across multiple sectors. In education, ICT facilitates interactive learning environments, virtual classrooms, and global knowledge sharing (Anderson & Weert, 2002). In business, ICT enhances productivity, streamlines communication, and supports innovation through data analytics and cloud computing. In governance, it improves transparency and efficiency through e-services and digital platforms (World Bank, 2020).

The growing importance of ICT is reflected in international development agendas. For instance, Goal 4 of the Sustainable Development Goals (SDGs) aims to “ensure inclusive and equitable quality education” and highlights the role of ICT in achieving this vision (United Nations, 2015).

Digital literacy extends beyond knowing how to operate a computer. It involves a spectrum of skills such as navigating the web, discerning credible information, engaging in digital communication, maintaining digital security, and understanding ethical dimensions of technology use (Ng, 2012). According to the American Library Association (2013), digital literacy includes "the ability to use information and communication technologies to find,

evaluate, create, and communicate information, requiring both cognitive and technical skills."

In today's world, digital literacy is crucial not only for academic and professional success but also for meaningful civic engagement. Individuals lacking digital skills are increasingly marginalized, unable to access online job applications, government services, or digital financial systems (Livingstone & Helsper, 2007).

Challenges to ICT and Digital Literacy Development  
Despite the recognition of its importance, several barriers hinder the effective development of ICT skills and digital literacy. These include:

- **Digital Divide:** Differences in access to ICT infrastructure between urban and rural areas, and between developed and developing nations, limit opportunities for many (OECD, 2019).
- **Lack of Policy Frameworks:** Inadequate educational policies and inconsistent ICT integration strategies in curricula restrict systematic skill development (Kozma, 2005).
- **Limited Teacher Training:** Many educators lack the competencies required to incorporate ICT meaningfully into teaching practices (Law et al., 2008).
- **Affordability:** High costs of devices and internet services make digital resources inaccessible to low-income populations (International Telecommunication Union, 2021).

To bridge these gaps, the following strategies have proven effective:

- **Curriculum Redesign:** Embedding digital literacy across all subjects to foster interdisciplinary ICT skills.
- **Professional Development:** Providing continuous training for teachers to integrate digital tools in pedagogy (Tondeur et al., 2012).
- **Infrastructure Investment:** Expanding access to affordable and reliable broadband in underserved areas.
- **Public-Private Partnerships:** Collaborating with tech companies to supply devices, training programs, and platforms.

- Community-Based Training: Offering digital literacy programs in libraries, community centers, and NGOs.

In preparing for future challenges, ICT and digital literacy must be regarded as fundamental life skills. Digital citizenship, ethical technology use, and innovation capacity are becoming essential attributes for global participation (Ribble, 2011). Education systems must therefore evolve from traditional content delivery to building competencies in digital learning, collaboration, and critical analysis.

Furthermore, governments must support inclusive digital ecosystems by adopting forward-looking policies and ensuring equitable access to ICT tools and literacy initiatives.

This study is therefore designed to investigate the role and importance of ICT and digital literacy in the 21st century, with specific focus on educational institutions in Nigeria. It further explores the level of access to digital resources, the capacity of educators and students to effectively utilize ICT, and strategies for bridging existing digital divides.

## II. AIMS AND OBJECTIVES OF THE STUDY

The study aims to evaluate the current landscape of ICT usage and digital literacy in secondary schools and to suggest strategies for improvement. The specific objectives are:

1. To assess the current level of ICT access and digital literacy among students and educators.
2. To examine the challenges limiting the integration of ICT in teaching and learning.
3. To analyze the impact of ICT access on students' academic performance.
4. To recommend practical solutions for improving digital literacy and ICT integration in schools.

## III. STATEMENT OF THE PROBLEM

Despite the recognized importance of ICT and digital literacy, many individuals, especially in developing countries, lack access to basic digital tools and skills. The digital divide persists due to infrastructure deficits, economic constraints, lack of policy support, and limited training opportunities for both students

and educators. Without targeted interventions, these gaps can widen existing inequalities and hinder socio-economic development (van Dijk, 2020).

## IV. PURPOSE OF THE STUDY

The purpose of this study is to investigate the relevance, challenges, and opportunities of ICT and digital literacy in the 21st century. It aims to assess the level of digital literacy among students and educators, identify the barriers to digital competence, and propose recommendations for improving access and integration of ICT in education.

## V. RESEARCH QUESTIONS

The following research questions are raised for this journal

1. What is the current level of digital literacy among students and teachers in selected schools?
2. What are the key challenges affecting ICT integration in the learning process?
3. How does access to ICT tools influence students' academic performance?
4. What measures can be adopted to enhance digital literacy in schools?

## VI. HYPOTHESIS

H<sub>0</sub>: There is no significant relationship between access to ICT resources and students' academic performance.

H<sub>1</sub>: There is a significant relationship between access to ICT resources and students' Academic

## VII. METHODOLOGY

This study employed a descriptive survey design using quantitative methods. The population consisted of secondary school students and teachers in three schools in Ekiti State, Nigeria. A stratified random sampling technique was used to select 150 respondents (120 students and 30 teachers). A structured questionnaire was developed to collect data on ICT access, usage, and perceptions of digital literacy. Data collected were analyzed using statistical tools including frequency counts, percentages, and Pearson correlation analysis to test the hypothesis.

VIII. RESEARCH DESIGN

This study adopted a descriptive survey design. The approach is suitable for collecting factual and attitudinal data from a representative sample to describe current conditions and relationships among variables. The design was chosen to allow for the collection of both quantitative and qualitative data regarding the use, accessibility, and effectiveness of ICT in educational settings.

IX. POPULATION AND SAMPLE

The population for the study comprised secondary school students and teachers in Ekiti State, Nigeria. The sample consisted of 150 respondents—120 students and 30 teachers—from three randomly selected secondary schools, one secondary school from each senatorial district in Ekiti State

X. SAMPLING TECHNIQUE

Astratified random sampling technique was employed to ensure proportional representation of different categories (students and teachers). Each school contributed participants from junior and senior secondary classes, and both male and female participants were included.

XI. DATA COLLECTION INSTRUMENT

The primary instrument for data collection was a structured questionnaire. The questionnaire was divided into four sections:

1. Demographic data
2. Access to ICT tools
3. Usage patterns and digital literacy levels
4. Perceived challenges and suggestions for improvement

The instrument included a mix of multiple-choice and Likert-scale items for ease of analysis.

The Likert scale items enabled respondents to express the degree of agreement or frequency with specific statements related to ICT access, digital literacy skills, perceptions, and challenges.

XII. RESPONSE CATEGORIES AND WEIGHTINGS

Each Likert-scale question was structured using the following 5-point response format:

Response Option	Weight (Score)
Strongly Agree (SA)	5
Agree (A)	4
Neutral (N)	3
Disagree (D)	2
Strongly Disagree (SD)	1

These weights were assigned numerically to aid the computation of mean scores, which were then used to evaluate the respondents’ collective views.

XIII. DECISION RULE AND CUT-OFF POINT

To make decisions on whether respondents agreed or disagreed with each statement, the mean cut-off point was determined as follows:

Formula:  $Cut-off\ Mean = \frac{5+4+3+2+1}{5} = \frac{15}{5} = 3.00$   
 This gives a cut-off point of 3.00, which is the neutral threshold.

Mean Score	Interpretation
4.50 – 5.00	Strong Agreement
3.50 – 4.49	Moderate Agreement
3.00 – 3.49	Neutral/Undecided
2.00 – 2.99	Moderate Disagreement
1.00 – 1.99	Strong Disagreement

Thus:  
 A mean  $\geq 3.00$  implies agreement/positive tendency (depending on context).  
 A mean  $< 3.00$  implies disagreement/negative tendency.

Response format: 5-point Likert scale  
 Weightings: SA = 5, A = 4, N = 3, D = 2, SD = 1  
 Cut-off point: 3.00 (neutral boundary for acceptance or rejection)  
 Decision Rule: Mean  $\geq 3.00$  = Accept; Mean  $< 3.00$  = Reject

This method ensures objectivity and statistical validity in interpreting questionnaire results and helps

translate qualitative perceptions into meaningful quantitative conclusions.

XIV. VALIDATION OF INSTRUMENT

The questionnaire was reviewed by two ICT education experts to ensure its content and face validity. Modifications were made based on their feedback. A pilot test was conducted in a different school to ensure clarity and consistency of the items.

XV. DATA COLLECTION PROCEDURE

Following the approval of school authorities and the ethical clearance to conduct research, questionnaires were distributed to the selected respondents. Participation was voluntary, and confidentiality was guaranteed. The collection process lasted one week.

XVI. METHOD OF DATA ANALYSIS

Quantitative data were analyzed using descriptive statistics (frequency, mean, percentage) and inferential statistics, particularly Pearson Product-Moment Correlation to examine the relationship between ICT access and academic performance. The hypothesis was tested at a 0.05 level of significance using SPSS software.

XVII. RESULTS AND DISCUSSION

The data gathered from 150 respondents (120 students and 30 teachers) were analyzed using descriptive and inferential statistics.

Four-Point Scale and Cut-Off Point

Response Rating	Interpretation	Score (Mean value)
4	Very High/Strongly Agree	3.50 – 4.00
3	High/Agree	2.50 – 3.49
2	Low/Disagree	1.50 – 2.49
1	Very Low/Strongly Disagree	1.00 – 1.49

Cut-off Mean = 2.50, Any mean score  $\geq$  2.50 = Accepted/Agreed

Any mean score  $<$  2.50 = Rejected/Disagreed

Table 1: Students' Access to ICT Tools

For Yes = 4, No = 1

ICT Tool	Yes (%)	No (%)	Mean	Decision
Smartphone/Tablet Access	75%	25%	3.25	High (Accepted)
Computer/Laptop Access	65%	35%	2.95	High (Accepted)
Internet Access	45%	55%	2.35	Low (Rejected)
Daily ICT Use	50%	50%	2.50	Moderate (Borderline Acceptance)

XVIII. DISCUSSION

Students have adequate access to smartphones/tablets and moderate access to computers/laptops. However, their access to the internet is below average, with a mean of 2.35, which limits effective use of ICT tools for learning. Daily use of ICT tools stands at the borderline level (2.50), suggesting a need for structured engagement or interventions to ensure frequent use of ICT for academic activities.

Table 2: Students' Self-Rated Digital Literacy

Assume: High = 4, Average = 3, Low = 2

High (%)	Average (%)	Low (%)	Mean	Decision
25	60	15	3.10	High (Accepted)
30	50	20	3.10	High (Accepted)
35	50	15	3.20	High (Accepted)

Students rate themselves as digitally competent, especially in basic applications like Microsoft Word and PowerPoint, with mean scores above 3.00. Their ability to evaluate online information and awareness of online safety also show a positive trend. This implies that with sustained exposure and practice, students can attain even higher levels of digital literacy necessary for 21st-century skills.

Table 3: Teachers' Access and Training in ICT  
Yes = 4, No = 1

Item	Yes (%)	No (%)	Mean	Decision
ICT Use in Teaching	40	60	2.20	Low (Rejected)
Access to Devices in School	50	50	2.50	Moderate (Accepted)
Received Formal ICT Training	20	80	1.60	Very Low (Rejected)
Confidence in Digital Teaching	30	70	1.90	Low (Rejected)

Discussion

Teachers demonstrate low levels of engagement and training in ICT use. The very low mean score (1.60) on training suggests a serious gap in professional development. Similarly, their confidence level in using ICT for instruction is also low (1.90). Even though access to ICT tools is at a moderate level (2.50), lack of skills and training hampers effective utilization, potentially limiting the students' digital learning experience.

Table 4: Challenges Faced by Students in Using ICT Tools

We treat higher percentage as higher challenge.

Challenge	% Reporting	Converted Mean (Estimate)	Decision
Inconsistent Power Supply	78%	3.5	High Challenge
Lack of Internet Access	70%	3.2	High Challenge
Lack of Digital Devices	62%	3.0	High Challenge
Lack of Digital Skills	58%	2.8	Moderate Challenge
ICT Not Taught in School	49%	2.5	Moderate Challenge

Discussion

The mean ratings reveal that infrastructure-related issues such as erratic power supply and internet access are the most severe barriers to ICT integration in education. Lack of devices and digital skills also pose moderate challenges. The data highlights the urgent need for policy and infrastructure investments to bridge the digital divide and ensure equitable access to learning technology.

Table 5: Perceived Impact of ICT on Learning (Mean Analysis)

S/N	Statement	Mean Score	Decision
1	ICT makes learning more interesting	4.10	Strongly Accepted
2	ICT improves my academic performance	3.94	Strongly Accepted

Interpretation Rule: Mean  $\geq$  3.00 = Accepted Mean  $<$  3.00 = Rejected

Discussion

Students perceive ICT as having a highly positive impact on their learning. The mean scores above 3.90 for both statements reflect strong agreement that ICT enhances engagement and improves academic outcomes. This confirms the belief that digital learning tools are valuable in increasing motivation, participation, and performance.

Table 6: Hypothesis Test (ICT Access Versus Academic Performance)

Variable	Correlation Coefficient (r)	Significance Level (p)	Conclusion
ICT Access vs Academic Performance	0.61	0.03 (p < 0.05)	Significant positive correlation (H <sub>0</sub> rejected)

These tables represent how the raw data from the questionnaires was analyzed and reported to show clear relationships between ICT access, digital literacy, and educational outcomes. The hypothesis testing result reveals a significant positive correlation

( $r = 0.61$ ,  $p < 0.05$ ) between students' access to ICT tools and their academic performance. This statistically supports the claim that enhanced ICT access leads to better academic outcomes. The result reinforces the need to integrate ICT across subjects and invest in ICT infrastructures and teacher training programs.

#### XIX. HYPOTHESIS TESTING

Using Pearson correlation analysis:

A positive correlation was found between ICT access and academic performance ( $r = 0.61$ ,  $p < 0.05$ ).

Conclusion: The null hypothesis ( $H_0$ ) was rejected, confirming a statistically significant relationship.

#### XX. SUMMARY OF ALL DISCUSSIONS

Together, these tables and their interpretations paint a comprehensive picture of how information and communication Technology access and digital literacy are playing out in the sampled schools. While there is a growing awareness of the importance of technology in learning, significant gaps in access, training, and usage skills remain. These must be addressed through multi-stakeholder collaborations including the government, private sector, NGOs, and the education system.

The findings affirm the critical role of ICT and digital literacy in modern education. Students with greater access to ICT tools demonstrated better academic performance, confirming previous studies such as those by Livingstone & Helsper (2007) and Ng (2012). These tools enhance engagement, broaden access to knowledge, and foster independent learning.

Students show moderate to high ICT access, especially through smartphones.

They possess moderate digital literacy, with room for enhancement in skills like critical thinking and online safety.

Teachers lack sufficient training and confidence in digital teaching, posing a barrier to effective ICT implementation.

Students face notable challenges, especially power outages, poor internet access, and lack of devices.

Students strongly agree that ICT boosts learning and performance.

A statistically significant relationship exists between ICT access and academic success

However, digital inequality remains a serious concern. Most respondents lacked consistent access to internet-enabled devices and stable electricity—problems prevalent in many parts of Africa (van Dijk, 2020). The lack of teacher training reflects inadequate preparation within teacher education programs, aligning with the findings of Law et al. (2008).

The study also shows that digital literacy is more than technical proficiency. It encompasses the ability to critically evaluate content, ensure online safety, and contribute meaningfully to digital spaces. This supports Ribble's (2011) concept of digital citizenship.

Challenges such as unreliable electricity, inadequate internet infrastructure, and insufficient teacher training were also prominent, echoing findings by Law et al. (2008) and Kozma (2005). These findings underscore the urgent need for coordinated efforts to build digital capacity, especially in resource-constrained settings.

There is an urgent need for systemic reforms, including curricular updates, educator training, and public-private partnerships to provide digital infrastructure and learning resources.

#### CONCLUSION

ICT and digital literacy are indispensable tools in today's education and workforce development. While significant progress has been made, gaps remain in access and competency levels, especially in developing regions. This study has shown that ICT and digital literacy are essential skills for education and global competitiveness in the 21st century. Students and teachers with regular access to ICT

tools and adequate digital skills are better positioned to thrive in academic and real-world environments.

This study reinforces the importance of integrating ICT effectively into the curriculum and calls for a holistic approach to digital inclusion that considers infrastructure, training, policy, and community engagement.

However, challenges such as poor infrastructure, cost barriers, and insufficient training continue to widen the digital divide. The integration of ICT into the educational system requires not only hardware provision but also supportive policies, capacity development, and ongoing evaluation.

### RECOMMENDATIONS

Based on the findings, the following recommendations are made:

1. Government Investment: Increased funding for ICT infrastructure, especially in rural and underserved schools.
2. Curriculum Integration: Digital literacy should be a core component of both primary and secondary education curricula.
3. Teacher Training: Mandatory and continuous digital literacy training for educators at all levels.
4. Public-Private Collaboration: Partnerships with tech companies and NGOs to provide affordable digital tools and internet access.
5. Monitoring and Evaluation: Regular assessment of ICT usage and effectiveness to guide future interventions.
6. Community Involvement: Establish digital literacy centers in communities to promote lifelong learning and digital inclusion.

### REFERENCES

- [1] American Library Association. (2013). *Digital literacy definition*. Retrieved from <http://www.ala.org>
- [2] Anderson, J., & van Weert, T. (Eds.). (2002). *Information and communication technology in education: A curriculum for schools and programme of teacher development*. Paris, France: UNESCO.
- [3] Belshaw, D. (2014). *The essential elements of digital literacies*. Self-published.
- [4] International Telecommunication Union. (2021). *Measuring digital development: Facts and figures 2021*. Retrieved from <https://www.itu.int/en/ITU-D/Statistics/>
- [5] Kozma, R. B. (2005). National policies that connect ICT-based education reform to economic and social development. *Human Technology*, 1(2), 117–156.
- [6] Law, N., Pelgrum, W. J., & Plomp, T. (2008). *Pedagogy and ICT use in schools around the world: Findings from the IEA SITES 2006 study*. New York, NY: Springer.
- [7] Livingstone, S., & Helsper, E. J. (2007). Gradations in digital inclusion: Children, young people and the digital divide. *New Media & Society*, 9(4), 671–696. doi:10.1177/1461444807080335
- [8] Ng, W. (2012). Can we teach digital natives digital literacy? *Computers & Education*, 59(3), 1065–1078. doi:10.1016/j.compedu.2012.04.016
- [9] OECD. (2019). *How's life in the digital age? Opportunities and risks of the digital transformation for people's well-being*. Paris, France: OECD Publishing.
- [10] Ribble, M. (2011). *Digital citizenship in schools: Nine elements all students should know* (2nd ed.). Washington, DC: ISTE.
- [11] Tondeur, J., van Braak, J., Sang, G., Voogt, J., Fisser, P., & Ottenbreit-Leftwich, A. (2012). Preparing pre-service teachers to integrate technology in education: A synthesis of qualitative evidence. *Computers & Education*, 59(1), 134144. doi:10.1016/j.compedu.2011.10.009
- [12] UNESCO. (2018). *ICT in education*. Retrieved from <https://en.unesco.org/themes/ict-education>
- [13] United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development*. Retrieved from <https://www.un.org/sustainabledevelopment/>
- [14] van Dijk, J. (2020). *The digital divide*. Cambridge, UK: Polity Press.
- [15] World Bank. (2020). *World development report 2021: Data for better lives*. Retrieved from <https://www.worldbank.org/en/publication/wdr2021>