VOL. 09 NO. 9,
AUGUST, 2025
E-ISSN 3026-958X
P-ISSN 3027-1169

African Scholar Publications & Research International
www.africanscholarpub.com

Journal of Science Innovation & Technology Research (JSITR)

A Blueprint for Achieving Technological Literacy in Nigeria's Transport and Logistics Sector

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DOI: https://doi.org/10.70382/ajsitr.v9i9.034

Abstract
This study aims to develop a blueprint for achieving technological literacy among transport and logistics firms in Nigeria, aligning with the United Nations Sustainable Development Goals (SDGs) 4 (Quality Education), 8 (Decent Work and Economic Growth), and 9 (Industry, Innovation, and Infrastructure) by 2030. A critical review of 73 peer-reviewed empirical studies on technological literacy was conducted, and evidence from the review, combined with the authors' contextual knowledge of Nigeria, informed the blueprint's design. The findings identified and outlined eight practical and interconnected steps, collectively referred to as the Technology Literacy for All Nigerians (TELFAN) Blueprint, intended to guide the advancement of technological literacy within the transport and logistics sector. The TELFAN Blueprint serves as a comprehensive, step-by-step framework that can be adopted by the Nigerian government to promote nationwide technological competence, particularly within this key industry. Notably, it represents one of the first structured guides to achieving technological literacy from a developing country perspective.

Keywords: Technological literacy, Quality Education, Sustainable Development Goals, Critical Review, Transport, Logistics, Nigeria.

Introduction

Education is fundamental to the long-term sustainable development of any country thus; it comes as no surprise that the United Nations' fourth Sustainable Development Goal deals with the issue of Quality Education. In a knowledge-based global economy driven by technology, quality education, decent work and economic growth, industry innovation and infrastructure cannot be truly achieved without addressing the issue of technological literacy (Marisi, 2022).

Technology literacy refers to the ability to utilise, manage, comprehend, and evaluate technology (Nes et al., 2021). It also includes digital literacy, which refers to the ability to use digital devices like computers or smartphones to access the internet (Chiu et al., 2022). The user can use a variety of digital platforms, including web pages, periodicals, websites, and social media websites, to explore, generate, manage, review, and assess material on the internet (Barrie et al., 2021).

Technology literacy is now an important part of the curriculum in schools around the world (Shin and Lwin, 2022) to enable students to develop the ability to use technology to effectively address problems (Terton et al., 2022). It exposes students to a wide range of topics, encourages creativity, and encourages active learning (Romero-Hall and Jaramillo Cherrez, 2022). Besides the school context, technology literacy is important in all aspects of life, ranging from business to health and even social relationships (Morgan et al., 2022).

However, there is a distinct technological literacy divide between countries in the Great North and the Great South due to distinct differences in access to technological advancements and the foundational infrastructure needed to support technological literacy (Mathrani et al., 2021). This divide is further heightened given that the world is becoming more and more technology-driven with each passing year (Vimalkumar et al., 2021).

In light of the pressing need for technological advancement, this paper aims to develop a comprehensive, step-by-step blueprint to achieve technological literacy for all citizens of Nigeria, a nation situated in the Global South. To realize this goal, the paper delineates two primary objectives:

1. To conduct a critical review of extant empirical articles on technological literacy: This objective seeks to address four pivotal research questions through a thorough examination of existing empirical studies on technological literacy:
    a. Were technological literacy interventions successful in enhancing participants' technological literacy?
    b. What were the pieces of evidence that technological literacy interventions successfully enhanced participants' technological literacy?
    c. How were technological literacy interventions successfully implemented to enhance participants' technological literacy? and

d. What obstacles prevented technological literacy interventions from achieving their objectives in certain contexts?

2. To develop the blueprint for technological literacy for all Nigerians (TELFAN): This blueprint will be formulated based on the insights and evidence gathered from the critical review, combined with the researchers' extensive knowledge and experience within the Nigerian context.

The rest of the paper proceeds as follows: the methodology, findings and Implications, the TELFAN Blueprint, and conclusion.

Methodology

This section presents the methodological framework employed to conduct the critical review of empirical articles on technological literacy. It includes the criteria for article selection, data collection methods, and analytical techniques used to synthesize the findings. As mentioned in the introduction section, the critical review had four research questions which are restated as follows:

1. Were technological literacy interventions successful in enhancing participants' technological literacy?
2. What were the pieces of evidence that technological literacy interventions successfully enhanced participants' technological literacy?
3. How were technological literacy interventions successfully implemented to enhance participants' technological literacy?
4. What obstacles prevented technological literacy interventions from achieving their objectives in certain contexts?

The first research question was answered by reading the abstracts as well as the findings sections of the articles reviewed. These articles were then divided into two groups; those that found that technological literacy interventions successfully enhanced participants' technological literacy and those that found that these interventions were not successful. The second research question was answered based on information from the findings of the articles reviewed, and these articles were categorized based on the evidence of entrepreneurship training efficacy presented.

The third research question was answered using information obtained from the introduction or methodology sections of the articles reviewed where the specific implementation strategy used for the entrepreneurship training was described. These articles were then grouped based on the distinct implementation strategies identified. Finally, the fourth research question was addressed by reading the discussion sections of the articles reviewed. The articles were then grouped based on the obstacles identified.

Only empirical articles on technological literacy were used for this review so as to ensure that verifiable evidence rather than scholarly opinions was used to address the research questions. More so, empirical papers are based on observations, experiments, and real-world data, which provide evidence-based insights into a research problem. Using empirical studies allows the

reviewer to critically evaluate how theories and concepts perform in practice, assess the validity, reliability, and generalizability of the findings, and identify gaps, inconsistencies, or methodological weaknesses in existing research. Unlike purely theoretical or conceptual papers, empirical studies offer measurable outcomes that make the review more objective, evidence-driven, and grounded in reality. In essence, selecting empirical papers ensures that the critical review is not just a summary of ideas, but a rigorous analysis of real data, tested hypotheses, and verifiable conclusions, which strengthens the overall credibility and academic contribution of the work.

Google Scholar was used to search for relevant empirical articles with a specific focus on articles published by 12 reputable academic publishers. Three search terms were used to search for articles and the abstracts were read to ensure that only empirical articles investigating the impact of a technological literacy intervention on participants' technological competencies were selected. Table 1 presents the 12 academic publishers relied upon, the search terms used, the number of articles found and the number of articles that met the paper's selection criteria. It can be observed from Table 1 that 73 empirical articles were eventually used for this paper's critical review.

Table 1: Technological literacy article search process

	"Technological Literacy"			**"Technology Literacy"**			**"Digital Literacy"**				
S/N	**P**	**AF**	**AS**	**P**	**AF**	**AS**	**P**	**AF**	**AS**	**TOTAL ARTICLES FOUND**	**TOTAL ARTICLES SELECTED**
1.	**Emerald**	0	0	**Emerald**	7	2	**Emerald**	45	10	**52**	**12**
2.	**Elsevier**	5	1	**Elsevier**	10	3	**Elsevier**	93	6	**108**	**10**
3.	**Sage**	43	5	**Sage**	25	0	**Sage**	86	6	**154**	**11**
4.	**Springer**	35	5	**Springer**	27	2	**Springer**	217	11	**279**	**18**
5.	**Taylor and Francis**	19	2	**Taylor and Francis**	18	2	**Taylor and Francis**	151	12	**188**	**16**
6.	**Wiley**	3	0	**Wiley**	5	0	**Wiley**	57	0	**65**	**0**
7.	**Inderscience**	0	0	**Inderscience**	0	0	**Inderscience**	4	0	**4**	**0**
8.	**Ingenta**	0	0	**Ingenta**	0	0	**Ingenta**	0	0	**0**	**0**
9.	**Cambridge**	1	0	**Cambridge**	3	0	**Cambridge**	18	1	**22**	**1**
10.	**Oxford**	2	0	**Oxford**	2	0	**Oxford**	14	0	**18**	**0**
11.	**Jstor**	13	1	**Jstor**	11	4	**Jstor**	18	0	**42**	**5**
12.	**Harvard**	0	0	**Harvard**	0	0	**Harvard**	2	0	**2**	**0**
		121	**14**		**108**	**13**		**705**	**46**	**934**	**73**

P – publisher; AF – articles found; AS – articles selected

Findings and Discussion

This section discusses the results of the critical review, highlighting key findings and their implications for the development of the TELFAN Blueprint. It examines the effectiveness of various interventions, the evidence supporting their success, the strategies used for implementation, and the challenges encountered.

The answers to the paper's four research questions are provided based on the review of 72 technological literacy articles. In addition, the implications of these findings to the development of the Technological Literacy for All Nigerians (TELFAN) Blueprint are also discussed.

Were technological literacy interventions successful in enhancing participants' technological literacy?

Figure 1 presents the distribution of the 73 articles reviewed based on whether or not the interventions they described enhanced the technological literacy of the participants.

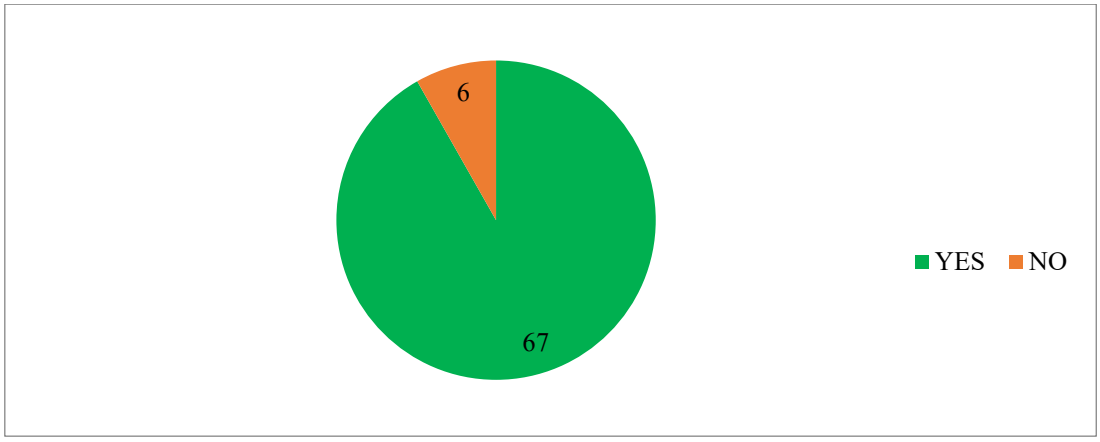


Figure 1: Success of interventions in enhancing technological literacy of participants
Source: Authors' review of 73 articles on technology literacy

It can be observed from Figure 1 that the vast majority of articles reviewed (67 out of 73; 92%) found that technology literacy interventions were effective in improving the technological competencies of participants. For example, Breen et al. (2022) found that a three-week long technological literacy workshop for 2661 undergraduate students in Ireland improved their skills utilizing technology. Similarly, Nogueira et al. (2022) found that a one-month long technological literacy course enhanced the technological literacy of 20 5th grade students in Brazil. Furthermore, Smith et al. (2022) revealed that a technological literacy toolkit containing ten stand-alone teaching units helped develop the technological capabilities of 21 undergraduate students in Finland, Slovenia and Spain.

On the other hand, six of the 73 articles (8%) reviewed indicated that some interventions did not achieve their objective of enhancing the technological literacy of participants. For example, Ndugane-Mokiwa and Tlale (2015), Suwana and Lily (2017) and Irfan and Salam (2020) found that technological literacy interventions were unsuccessful in achieving their objectives in South Africa, Indonesia and Pakistan respectively. The reasons for the lack of success of these interventions will be discussed in response to this paper's fourth research question. However, it is interesting to note that the three examples cited here all occurred in

Global South countries; countries that have some notoriety in terms of weak IT infrastructure relative to the Global North.

In terms of the prospects of the successful development and implementation of the TELFAN Blueprint, these findings indicate that technological literacy interventions have, for the most part, successfully enhanced the technological competencies of a different variety of participants across the globe. This serves as a positive signal that the same results can be achieved in the Nigerian context.

What were the evidences that technological literacy interventions successfully enhanced participants' technological literacy?

Figure 2 reveals that three broad types of data collection methods were used to provide evidences of the efficacy of an intervention in enhancing the technological literacy of participants: 1) Formal assessments, 2) Participant surveys and 3) Participant interviews. It is important to reiterate that these methods were obtained from the 67 articles (see Figure 1) reviewed that found that these interventions successfully enhanced participants' technological literacy.

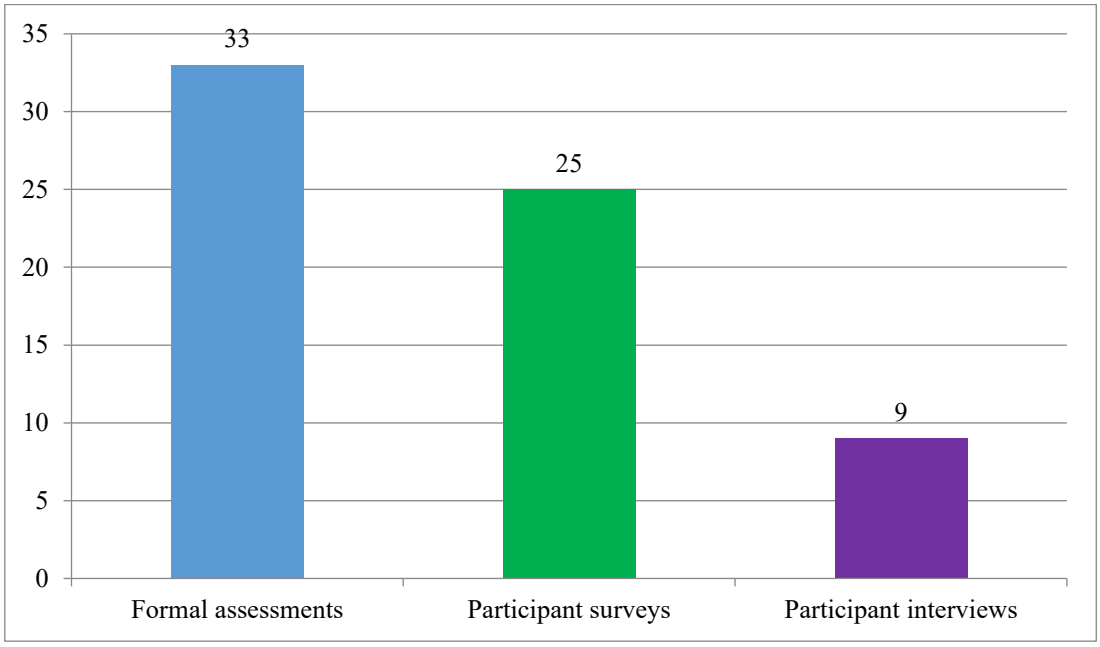


Figure 2: Data collection methods used to show evidence of efficacy of technological interventions

Source: Authors' review of 67 technological literacy articles (2022)

Formal assessments (33 of the 67 articles reviewed) typically involved the use of standardized tests or exams to measure the technological literacy of participants upon completion of the intervention (e.g., Tham et al., 2021; Nogueira et al., 2022; Pillai et al., 2022), with the most

robust of these studies adopting a pre-test/post-test control group design whereby the participants' technological literacy levels as well as that of a control group were measured prior to the start of the intervention (typically a course or a workshop). After the intervention, the technological literacy of the two groups would once again be measured and compared; evidence of intervention efficacy was obtained in two ways: first, the post-intervention technological literacy scores of the participants was significantly higher than their pre-intervention scores, and second the post-intervention scores of participants were significantly higher than the post-intervention scores of the control group.

An example of such a study was Silamut and Sovajassatakul (2021) who randomly selected 40 employees (20 as participants and 20 as the control group) from a Thai energy regulation company. The pre-intervention and post-intervention technological literacy of both groups was measured using the Academic Achievement and Technological literacy Ability assessment. The experimental group were taught technological literacy content using a model that combined self-directed learning and knowledge management while the control group were taught technological literacy content using the conventional lecture format. The results of a one-way MANOVA revealed that the experimental group had a significantly higher level of technological literacy than the control group at the end of the intervention.

Twenty five of the 67 articles reviewed for this section used questionnaires to solicit the perceptions of participants regarding to what extent the intervention had improve their technological literacy (e.g., La Rose and Detlor, 2021; Smith et al., 2022; Yu and Zadorozhnyy, 2022). Evidence of intervention efficacy was established if the questionnaires revealed that participants generally felt that the intervention had a positive impact on their technological literacy. Castilla et al. (2018) tested the efficacy of a technological literacy intervention aimed at elderly residents of a rural area in Spain. 46 participants between the ages of 60 and 76 were involved in the interventions which comprised of eight sessions using a social network with many navigation and application tools. A survey of the participants post-intervention revealed that they generally felt that the intervention had improved their technological literacy in terms of their ability to successfully handle and navigate ICT platforms.

Nine of the 67 articles reviewed relied on interviews with participants to decipher to what extent the specific technological literacy intervention was successful in achieving its objectives (e.g., Tsai et al., 2017; Lev-On et al., 2020; Breen et al., 2022). Similar to the participant survey strategy, this strategy was also reliant on the perceptions of the participants; for example, Breen et al. (2022) described a three-week long workshop aimed at improving the technological literacy of 2,661 undergraduate students in Ireland. Upon conclusion of the workshop, focus group interviews with participants revealed that there was a general perception that the workshop had been beneficial in improving their technological literacy.

The problem with evidences based on perception (participant survey and interviews) as compared to formal assessments that rely on performance on objective tests is that the former is typically susceptible to social desirability bias whereby participants give responses that

portray themselves as more digitally literate than they really are. Based on this critique, it is strongly recommended that the formal assessment process be the primary mode of determining the efficacy of a technological literacy intervention in the context of the TELFAN Blueprint that will be presented in the next section of this paper.

How were technological literacy interventions successfully implemented to enhance participants' technological literacy?

In order to answer this research question, the 67 articles reviewed in the previous subsection were once again relied upon, and Figure 3 presents the answers to this third research question.

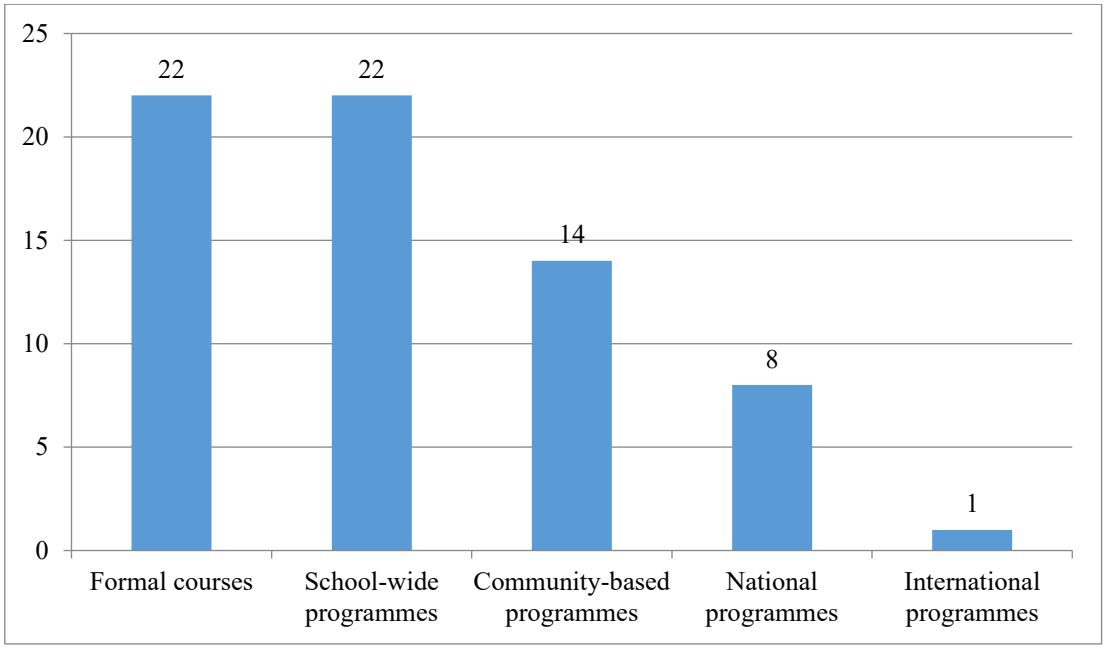


Figure 3: Different successful technological literacy implementation strategies
Source: Authors' review of 67 technological literacy articles

Figure 3 shows that five broad implementation strategies were successfully utilized to enhance the technological literacy of participants among the 67. The two most commonly used strategies were 'formal courses' (22 out of 67) and 'school-wide programmes' (22 out of 67). These were followed by 'community-based programmes' (14 out of 67), then 'national programmes' (8 out of 67) and finally 'international programmes' (1 out of 67).

'Formal courses' usually involved the introduction of a new technology literacy course or workshop to the existing curriculum at primary (elementary), secondary or tertiary institutions (e.g., Ikpeze, 2018; Weber et al., 2018; Cetin, 2021). Cetin (2021) explained that it was important for teachers themselves to be technologically literate if they are expected to teach students to become competent with technology. Based on this important premise, the author developed a literacy course based on digital storytelling. 46 Turkish pre-service computer

science teachers went through the course, and higher technological literacy scores upon completion of the course as well as positive evaluations of the course by the teachers revealed its efficacy in enhancing technological literacy.

'School-wide programmes' typically involved technological literacy initiatives adopted by the entire school system in order to enhance the technological competencies of all students (e.g., Breen et al., 2022; Nogueira et al., 2022; Smith et al., 2022). Breen et al. (2022) discuss such an initiative at the University of Limerick, Ireland where the University library was tasked with implementing a three-week "digital upskilling programme" for all students during the 2021 academic year. The study reported the outcome of focus group interviews with participating students which revealed that students collectively felt that the programme was successful in improving the technological literacy.

'Community-based programmes' were technological literacy interventions conducted outside of the traditional school environment, with a focus on specific members of the community such as ethnic minorities (Temdee, 2021) and the elderly (Castilla et al., 2018; Seo et al., 2019). Seo et al. (2019) developed a weekly, four-month long computer class for 47 elderly low-income African-American adults. Results of seven focus group interviews with the participants revealed that the class had improved their computer usage competence.

'National programmes' involved technological literacy interventions that had a national scope as opposed to being situated in a single community or school (e.g., Terry et al., 2019; Lev-On et al., 2020; Ollerenshaw et al., 2021). Lev-On et al. (2020) investigated the long-term effects of an Israeli government technological literacy programme for disadvantaged populations as perceived by participants one year after completing the course. Interviews with 61 participants revealed that the programme resulted in increased knowledge, confidence in using technology, empowerment, and a greater sense of self-efficacy.

Bernsmann and Croll (2013) was the only study reviewed that presented a technological literacy intervention that involved international collaboration. Specifically, the study discussed the Technological literacy 2.0 initiative sponsored by the EU Lifelong Learning Programme which involved libraries from Belgium, Bulgaria, France, Germany, and Poland, in collaboration and exchange with welfare organisations from Germany, the United Kingdom, and Portugal, piloting a two-step approach to attract educationally disadvantaged target groups like homeless people to libraries by providing them with an appealing starting point to information and social services (Bernsman and Croll, 2013). The study found that technological literacy programmes can be effective if they offer participants skills they can use in their daily lives and require minimal commitment of time and effort from these participants (Bernsman and Croll, 2013).

In the context of the TELFAN Blueprint developed in the next section, the key implications of these findings are that an effective national technological literacy plan involves serious funding commitment in terms of training the teaching staff and ensuring that a robust ICT infrastructure is put in place. Additionally, rigorous M&E mechanisms must be put in place to

properly measure the efficacy of the various school-based and community-based initiatives that would constitute a national technological literacy plan.

What obstacles prevented technological literacy interventions from achieving their objectives in certain contexts?

To answer this research question, information obtained from the six articles in Figure 1 that found that some interventions did not enhance technological literacy was relied on. Figure 4 presents the major obstacles that hindered these interventions from achieving their ultimate objectives.

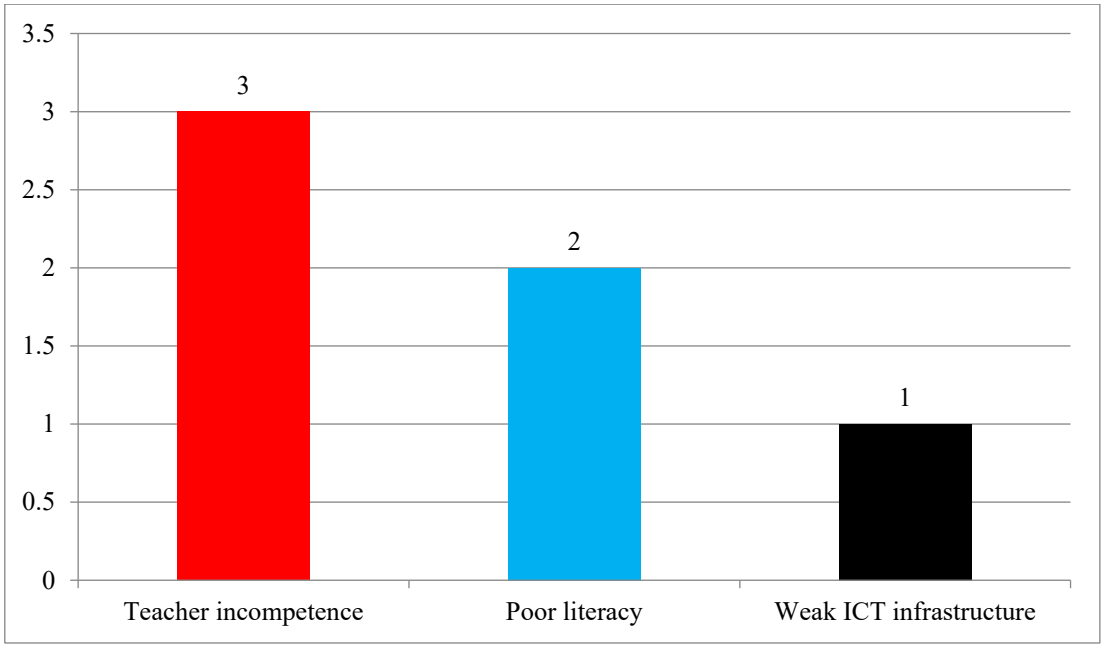


Figure 4: Obstacles preventing technological literacy interventions from achieving their objectives

Source: Authors' review of six technological literacy articles

As hypothesized by Cetin (2021) in the previous subsection, Figure 4 shows that teacher technological literacy is an important pre-requisite for successfully enhancing the technological competences of students and non-students alike. Three of the six studies reviewed in this subsection found that incompetence of teacher's tasked with teaching participants about technological literacy was the major obstacle that hindered the success of the intervention; everything from the content being too boring (McCallum et al., 1987) and the teachers lacking the technical expertise to effectively teach the content (Jane, 1990; Colwell et al., 2013). Colwell et al. (2013) explain how a teacher's ineffective teaching style scuppered the success of an intervention aimed at improving the internet-usage capabilities among American middle school students.

Two studies (Suwana and Lily, 2017; Irfan and Salam, 2020) found that participants with poor general literacy levels (ability to read and write) had tremendous difficulty in gaining technological literacy despite the best efforts of intervention teachers; a solid basic literacy level was thus identified as an important prerequisite for attaining technological literacy. Irfan and Salam (2020) discussed an empowerment programme called Digitize to Equalize that was funded by the Kaarvan Crafts Foundation with the main objective of enhancing the technological literacy of rural female entrepreneurs in Pakistan. Poor basic literacy levels among most of the participants prevented them from understanding the technological skills they were being taught thus leading to an unsuccessful intervention.

Finally, Ngubane-Mokiwa and Tlale (2015) found that weak ICT infrastructure at three juvenile facilities in the South African province of Gauteng was the major obstacle preventing children in these facilities from enhancing their technological literacy through an open distance technological literacy initiative. Technological literacy is gained most effective through a 'learning by doing' approach and this can only take place when the necessary technology infrastructure is available and robust (O'Brien et al., 2022). In implementing TELFAN, these three obstacles (teacher incompetence, poor literacy and weak ICT infrastructure) have to be directly addressed as they are prevalent in Nigeria. These obstacles further highlight the financial commitment that the Nigerian government must be prepared to have any aspirations of achieving the fourth (4) Quality Education, eight (8) Decent Work and Economic Growth and ninth (9) Industry, Innovation and Infrastructure of United Nations Sustainable Development Goals (SDGs) by 2030.

Technological Literacy for all Nigerians (TELFAN) Blueprint

This section introduces and elaborates on the Technological Literacy for All Nigerians (TELFAN) Blueprint for transport and logistics sectors. It outlines the proposed steps and strategies for achieving technological literacy across Nigeria, drawing on the insights gained from the critical review and contextualizing them within the Nigerian socio-economic landscape.

As mentioned in the introduction, this paper had two main objectives; first, to critically review extant, high-quality empirical articles on the efficacy of different interventions in enhancing the digital literacy of citizens. Second, to develop a practical and comprehensive technological literacy blueprint for Nigeria based on the lessons learned from the critical review and the researchers' in-depth knowledge of the peculiarities of Nigeria's society. This section presents the achievement of the paper's second objective, the Technological Literacy for all Nigerians (TELFAN) Blueprint; Figure 5 presents the TELFAN Blueprint.

The first step of the TELFAN Blueprint is a radical change in the way the Nigerian government views education. Since adopting a democratic system of governance in 1999, the quality of education has steadily declined as successive governments have failed to give the education sector the attention it deserves (Agbai and Okafor, 2021). This neglect has been evidenced by dilapidated schools at primary, secondary and tertiary levels, a declining quality of teachers

and lecturers due to entrenched nepotism and shying away from a culture of meritocracy as well as incessant industrial strike actions by academic staff unions at all levels of education (Ogunode et al., 2022). A further unwanted consequence of this neglect has been the severe decline in the literacy levels of students being produced by these underfunded and underequipped educational institutions (Amadioha and Akor, 2021). As if things were not bad enough, a significant portion of funding made available for the sector is misappropriated by some individuals tasked with ensuring funds are judiciously used (Agbo, 2021). This anti-public behaviour is exacerbated by weak monitoring and evaluation processes and a selective enforcement of laws against embezzlement and corruption (Yakubu and Aboho, 2021). The dream of "Quality Education" "Decent Work and Economic Growth" and "Industry, Innovation and Infrastructure" of United Nations Sustainable Development Goals (SDGs) by 2030 will remain just a dream unless education becomes a major priority of the Nigerian government and robust M&E mechanisms are put into place to ensure that the sector gets the much-needed upgrades it requires. As Suwana and Lily (2017) and Irfan and Salam (2020) found, poor literacy levels are significant obstacles for achieving technological literacy for a country's citizens.

"As a result of the poor state of the education system in Nigeria, the World Bank, in collaboration with the Federal and State Ministries of Education, is implementing initiatives aimed at improving access to quality education. One of such efforts is the Adolescent Girls Initiative for Learning and Empowerment (AGILE) project, which seeks to enhance learning opportunities and empower young learners, particularly girls.Under this project, a key component known as the "Digital Literacy and Remote Learning Platform" has been established to promote and scale up digital literacy across schools. This component focuses on equipping students and teachers with the necessary digital skills to effectively participate in technology-driven learning environments, thereby bridging the digital divide and improving overall educational outcomes in Nigeria."

Technological literacy education is most effective when a hands-on approach, learning by doing approach is adopted (O'Brien et al., 2022). This implies that underlying infrastructure like high-speed internet and stable electricity must be established across the country for any sustainable technological literacy intervention to be effective. Unfortunately, in Nigeria these critical infrastructures are epileptic at best and this must change if technological literacy for all Nigerians is to become a reality. This is why step two of the Blueprint emphasizes an upgrade of Nigeria's ICT infrastructure. The issue of epileptic power supply can be addressed if the traditional hydroelectric power supply is complemented with a robust renewable energy initiative utilizing solar and wind energy which are in abundance in Nigeria.

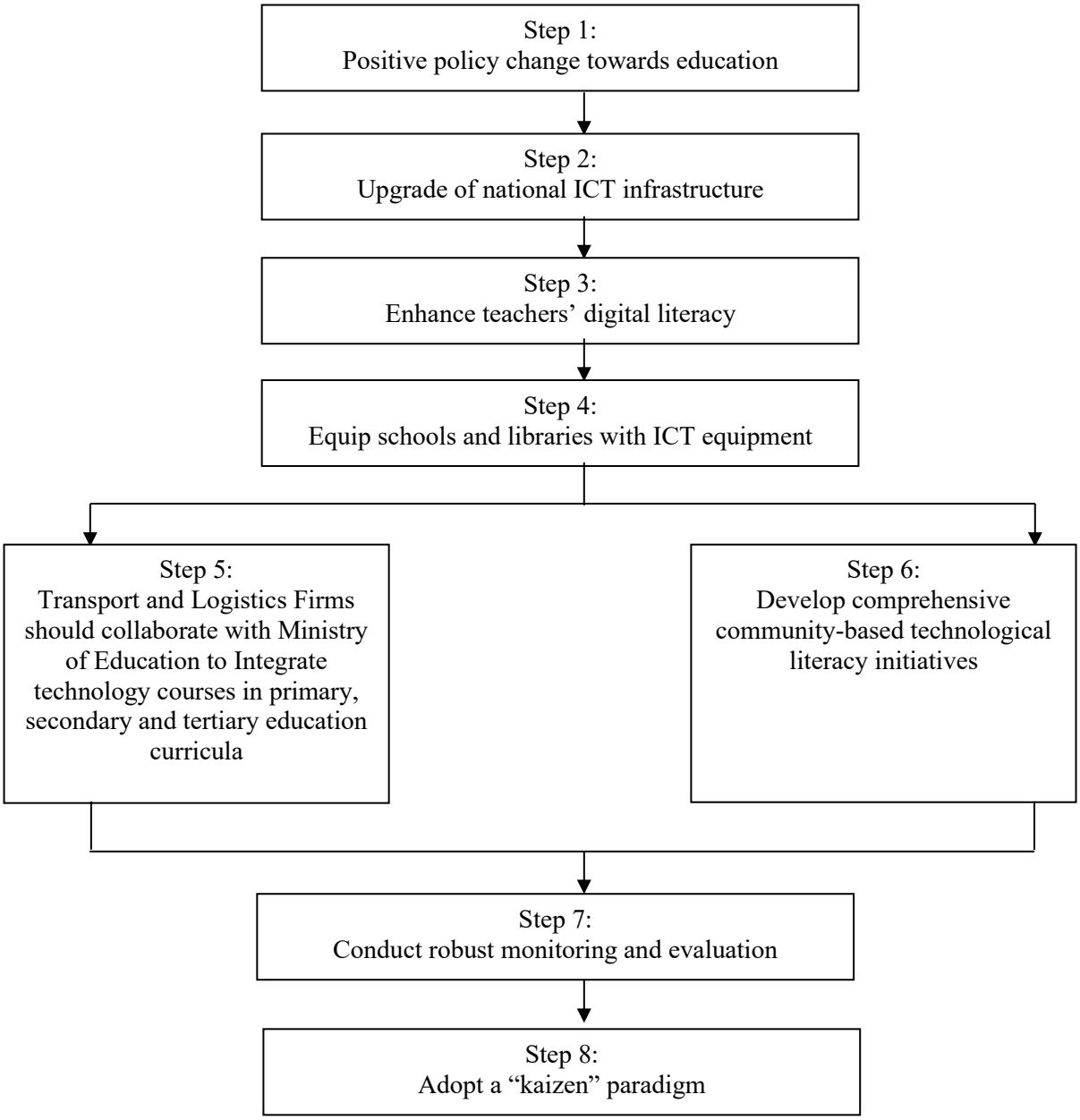


Figure 5: Technology Literacy for All Nigerians (TELFAN) Blueprint
Source: Authors (2022)

The third step of the blueprint suggests that a nationwide upgrading of teachers' digital literacy is very important for the success of a national technological literacy policy due to the fact that they will be relied upon to effectively teach the citizenry technology competence. This suggestion is in line with the findings of McCallum et al. (1987), Jane (1990) and Colwell et al. (2013) who all found that teacher incompetence was a significant obstacle for enhancing

the technological literacy of participants. An important question is who will teach the teachers? Initially, technology literacy consultants will be required to conduct 'train the trainers' workshops until a critical mass of trained teachers are attained. These trained teachers can then teach other teachers until all teachers possess an acceptable level of technology literacy needed to effectively teach their allocated students and participants. The training must thus include a robust assessment component in order to certify the technological competence of trainees.

The TELFAN Blueprint envisions educational institutions as being responsible for enhancing the technological literacy of enrolled students while public libraries as being responsible for training other members of the society. Based on this supposition, Step 4 of the blueprint recommends that all schools and public libraries be equipped with the requisite ICT equipment needed to properly teach participants how to engage with technology using a hands-on approach. Ensuring the security of this equipment is also of critical importance due to past history of such equipment being stolen by thieves (Yusuf et al., 2021).

The TELFAN Blueprint recommends that steps 5 and 6 be performed simultaneously. Step 5 involves a review of current educational curricula at all levels and developing and integrating innovative, environment and age-appropriate technological literacy courses into the curricula. This strategy has been found to be an effective way of enhancing the technological literacy of students around the world (Ikpeze, 2018; Weber et al., 2018; Cetin, 2021). Concurrently, Stage 6 of the Blueprint recommends that public libraries develop community-based technological literacy initiatives such as workshops to address non-students like small business owners, the elderly, people in the rural areas and other relevant groups of the society that are typically disadvantaged in terms of technological literacy (Castilla et al., 2018; Seo et al., 2019; Salam, 2020).

A major problem that plagues Nigeria in terms of policy implementation is an extremely weak monitoring and evaluation system (Daodu et al., 2021). It is this weakness that makes fund misappropriation very easy. In addition, a lack of evaluation means that the impact of policies vis-à-vis the achievement of their intended objectives as well as identification of obstacles that hindered success are never truly known and thus no learning takes place for the improvement of future policies. This is why Step 7 of the Blueprint strongly recommends the institution of a robust M&E process to ensure that the monies earmarked for the national technological literacy policy are used for their designated purposes. In addition, the evaluation portion of the process will enable the impact of the policy to be determined and for lessons to be learnt on how to improve future iterations of the policy. Lev-On et al. (2020) provide a practical example of how a national technological literacy policy can be evaluated through interviews with participants a year after specific programmes are completed.

The final step of the TELFAN Blueprint strongly recommends that a "kaizen" paradigm be adopted. Kaizen is a Japanese management concept which means continuous improvement (Kurnia et al., 2022). In the context of this Blueprint, this paradigm suggests that the Government should never be satisfied with any successes recorded in developing the literacy of all Nigerians. Rather, lessons learnt from robust M&E processes in Step 7 should be

integrated into the next iteration of the Policy so that a culture of constantly seeking perfection is institutionalized in all organizations tasked with the implementation of the policy.

This paper is under no illusion that the TELFAN Blueprint will be easy to implement given the many obstacles that need to be overcome for sustainable success to be attained. However, as Aristotle once famously said, "The fruits of education are bitter, but the fruit is sweet". Improving the lives of Nigerian citizens was never supposed to be easy, but it is a fundamental duty of Government to try, and technological literacy is a crucial skill-set in a world that is driven by technology.

Implementation Sequencing, Key Actors, and Measurable Outcomes

The successful realization of the TELFAN Blueprint requires a phased and well-coordinated implementation strategy involving multiple stakeholders. Implementation sequencing ensures that each stage builds upon the previous one, while clearly identifying responsible actors, measurable outcomes, and realistic timelines.

Implementation Sequence Overview

The implementation process should be executed in three interlinked phases:

I. Foundation Phase (Short-term: 0–2 years) – Policy reforms, ICT infrastructure assessment, and teacher training kick-off.
II. Expansion Phase (Medium-term: 3–5 years) – Deployment of ICT tools in schools, curriculum integration, and community-based literacy initiatives.
III. Sustainability Phase (Long-term: 6–10 years) – Continuous monitoring, evaluation, and improvement ("Kaizen" phase).

Table 2: Implementation Matrix

Step / Activity	Responsible Agency / Key Actors	Timeframe	Expected Outcome / Success Indicators
1. Policy reform and prioritization of education	Federal Ministry of Education (FME), National Council on Education (NCE), State Ministries of Education	0–1 year	Revised national education policy reflecting technology literacy objectives; increased budgetary allocation to education.
2. Upgrade of national ICT and energy infrastructure	Ministry of Communications, Innovation & Digital Economy (MCIDE), Ministry of Power, Nigerian Communications Commission (NCC), private telecoms and energy firms	1–4 years	70% broadband penetration, stable internet connectivity in 80% of public schools, increased renewable energy access.
3. Nationwide teacher digital literacy training	Teachers' Registration Council of Nigeria (TRCN), National Teachers' Institute (NTI), NGOs (e.g., UNICEF), donor agencies (World Bank through AGILE)	1–3 years	75% of teachers certified as digitally literate; inclusion of ICT teaching modules in NTI programs.

Step / Activity	Responsible Agency / Key Actors	Timeframe	Expected Outcome / Success Indicators
4. Provision of ICT facilities to schools and libraries	Universal Basic Education Commission (UBEC), Tertiary Education Trust Fund (TETFUND), local governments, NGOs, private partners	2–5 years	ICT labs established in 70% of public schools and 50% of community libraries; effective use of e-learning tools.
5. Integration of technology and digital literacy into school curricula	Nigerian Educational Research and Development Council (NERDC), FME, transport and logistics firms (industry partnership)	3–6 years	Revised curriculum with compulsory technology literacy courses across all levels; students demonstrate digital proficiency.
6. Community-based technological literacy initiatives	Public libraries, local councils, NGOs, Ministry of Women Affairs, Ministry of Youth and Sports Development	3–6 years	1,000 community ICT hubs established; 1 million adults and youths trained on digital literacy skills.
7. Monitoring, evaluation, and accountability systems	National Planning Commission (NPC), Office of the Auditor-General, civil society organizations, academia	2–10 years (continuous)	Annual M&E reports; transparent expenditure tracking; measurable improvement in digital skill indices.
8. Continuous improvement (Kaizen) mechanism	FME, MCIDE, universities, and innovation hubs	5–10 years	Regular curriculum review; integration of lessons learned into policy updates; sustained digital literacy growth.

Table 3: Key Performance Metrics

Metric	Primary Focus	Strategic Significance
Digital Literacy Rate	National skill level	Core measure of national progress toward technological empowerment
Teacher Digital Competence Index	Human capital quality	Ensures sustainability and effectiveness of digital education
ICT Infrastructure Coverage	Physical access	Enables equitable access to digital learning tools
Student Digital Participation Rate	Learning engagement	Measures adoption of e-learning culture in schools
Community ICT Hub Utilization Rate	Social inclusion	Expands digital literacy beyond formal education

Application of the TELFAN Blueprint to Nigeria's Transport and Logistics Sector

Although the TELFAN Blueprint provides a national framework for achieving technological literacy, its strategic focus on the transport and logistics sector is particularly critical. This sector serves as the backbone of trade, supply chain operations, and economic growth. By embedding technological literacy within transport and logistics firms, the blueprint directly

supports efficiency, competitiveness, and sustainability within Nigeria's rapidly evolving mobility and logistics ecosystem. It will help in:

i. **Enhancing Logistics Efficiency through Technological Literacy:** Technological literacy enables personnel at all level's drivers, dispatchers, warehouse staff, and managers to effectively use digital tools for real-time coordination, tracking, and process optimization. Digitally literate staff can use mobile logistics applications for shipment updates, vehicle routing, and delivery confirmations, reducing communication delays. Furthermore, data analytics and digital dashboards allow firms to monitor turnaround times, inventory levels, and bottlenecks, leading to quicker decision-making.

ii. **Improving Fleet Management and Operational Safety:** Fleet management is a major cost and safety concern in the Nigerian transport industry. Digital literacy ensures that employees can effectively operate telematics systems, GPS trackers, fuel sensors, and driver monitoring software. Fleet managers can analyze vehicle performance data to plan maintenance schedules, reducing breakdowns and operational downtime. This means that drivers with basic technological training can use on-board diagnostic systems to identify mechanical issues before they escalate. Also, Supervisors can use fleet management software to monitor driver behavior and enforce compliance with transport safety standards.

iii. **Facilitating Digital Compliance and Regulatory Efficiency:** Technological literacy also supports digital compliance, a growing requirement within the global logistics value chain. With the automation of customs clearance, cargo documentation, and transport permits, firms increasingly require staff who can navigate online portals such as the Nigeria Customs Integrated System (NICIS II), drivers and logistics officers must be able to upload digital manifests, track customs processes, and maintain electronic proof of delivery.

iv. **Integrating Smart Transport Systems:** The future of logistics lies in smart mobility, where technology and data drive transportation planning and service delivery. The TELFAN Blueprint can serve as a foundation for:
    - Training personnel in Internet of Things (IoT) technologies for real-time vehicle tracking and predictive maintenance.
    - Building capacity in Geographic Information Systems (GIS) for route mapping, accident analysis, and infrastructure planning.
    - Encouraging innovation hubs to develop local transport-tech solutions, such as e-hailing, digital ticketing, and automated cargo handling.

v. **Strengthening Collaboration between Education, Government, and Industry:** The transport and logistics sector's integration into the TELFAN Blueprint requires active collaboration between key stakeholders:

- The Federal Ministry of Transportation, in partnership with the Ministry of Education, can embed digital literacy modules tailored to logistics into curricula at universities and vocational centers.
- Private logistics firms can provide practical training platforms and internships to reinforce classroom learning with real-world applications.
- Regulatory bodies such as the Nigerian Shippers' Council, Nigerian Institute of Transport Technology (NITT), Federal University of Transportation Daura (FUTD) and Nigerian Port Authority (NPA) can offer sector-specific digital certification programs to enhance professional standards.

Conclusion

The paper concludes with a summary of the key findings, the proposed blueprint, and recommendations for future research and policy initiatives to support the widespread adoption of technological literacy in Nigeria.

Five years remain until 2030 arrives when all 17 Sustainable Development Goals are expected to have been achieved. This paper was particularly interested in the attainment of SDG 4 'Quality Education', 8 'Decent Work and Economic Growth' and 9 'Industry, Innovation and Infrastructure' of United Nations Sustainable Development Goals (SDGs) by 2030 in Nigeria, with a specific emphasis on the achievement of technological literacy in transport and logistics for all Nigerians. The emphasis on technological literacy was based on the fact that the world today and for the foreseeable future is technology-driven and thus no education, workplace and industry can truly be considered world-class if it is devoid of technological literacy.

The paper had two broad objectives: first to obtain evidence of the efficacy of technological literacy interventions on enhancing the technological competences of the participants of these interventions from a global perspective. Second, was to develop a practical blueprint which the Nigerian Government could utilize to ensure that all Nigerians become technologically literate with much emphasis on transport and logistics sector, hopefully before the 2030 SDG deadline.

The first objective was achieved by critically assessing 73 empirical articles on technological literacy interventions published by the most reputable academic publishers in the world. The review revealed that educational interventions did in fact have great success in enhancing the technological literacy of participants across the globe based on formal assessments as well as the collective perceptions of the beneficiaries themselves. In addition, the introduction of formal courses into the educational curricula as well as the development of workshops for non-students were found to be quite effective in enhancing technological literacy of people from all works of life. However, teacher incompetence, poor basic literacy levels and weak ICT infrastructure were found to be obstacles for the successful use of interventions to enhance technological literacy.

Based on the evidences obtained from the critical review and the in-depth knowledge of the authors regarding the Nigerian experience, a blueprint dubbed the Technological Literacy for

All Nigerians (TELFAN) Blueprint, was developed and the implementation process explained via eight interconnected steps. The authors propose that if the TELFAN Blueprint is judiciously and wholeheartedly implemented, then quality education, decent work and economic growth, industry, innovation and infrastructure as it pertains to technological literacy for Nigerians in a technology-driven world can become a reality in the not-too-distant future.

References

Agbai, E. and Okafor, A., 2021. Comparative Study of Education Funding in Nigeria. *Journal of Education and Practice*, *12*(5), pp.1-12.

Agbo, C.O., 2021. Human Capital Impact on Economic Growth in Nigeria. *Nile Journal of Business and Economics*, *7*(18), pp.15-22.

Amadioha, S.W. and Akor, V.O., 2021. Students' Perception of Curriculum and Corruption Free Tertiary Education: A Case of Rivers State University. *Nigerian Journal Of Curriculum Studies*, *27*(2), pp. 30-39.

Barrie, H., La Rose, T., Detlor, B., Julien, H. and Serenko, A., 2021. "Because I'm Old": The Role of Ageism in Older Adults' Experiences of Digital Literacy Training in Public Libraries. *Journal of Technology in human ServiceS*, *39*(4), pp.379-404.

Bernsmann, S. and Croll, J., 2013. Lowering the threshold to libraries with social media: the approach of "Digital Literacy 2.0", a project funded in the EU Lifelong Learning Programme. Library Review, 62(1/2), pp. 53-58.

Breen, M., Waters, J. and O'Shea, L., 2022. Taking a Lead on Digital Literacy for Students—A Case Study from the Library at the University of Limerick. *New Review of Academic Librarianship*, pp.1-22.

Castilla, D., Botella, C., Miralles, I., Bretón-López, J., Dragomir-Davis, A.M., Zaragoza, I. and Garcia-Palacios, A., 2018. Teaching digital literacy skills to the elderly using a social network with linear navigation: A case study in a rural area. International Journal of Human-Computer Studies, 118, pp.24-37.

Çetin, E., 2021. Digital storytelling in teacher education and its effect on the digital literacy of pre-service teachers. Thinking Skills and Creativity, 39, pp. 1-25

Chiu, T.K., Sun, J.C.Y. and Ismailov, M., 2022. Investigating the relationship of technology learning support to digital literacy from the perspective of self-determination theory. *Educational Psychology*, pp.1-20.

Colwell, J., Hunt-Barron, S. and Reinking, D., 2013. Obstacles to developing digital literacy on the Internet in middle school science instruction. Journal of Literacy Research, 45(3), pp.295-324.

Daodu, S.A., Mohamad, S. and Jasmani, Z., A., 2021. Systematic Review of Open Space Implementation in Nigeria. *International Journal of Social Science and Human Research, 4*(11), pp. 3257-3264.

Ikpeze, C.H., 2018. Designing e-books: Enhancing prospective teachers' digital literacy skills. Available at: https://www.emerald.com/insight/content/doi/10.1108/S2048-045820180000009003 (Accessed 2nd June 2022)

Irfan, T. and Salam, M.T., 2020. Kaarvan Crafts Foundation: embracing digital literacy for women empowerment. Emerald Emerging Markets Case Studies. Vol. 10 No. 4. https://doi.org/10.1108/EEMCS-06-2020-0215

Jane, B.L., 1990. Australian studies: A vehicle for scientific and technological literacy?. Research in Science Education, 20(1), pp.152-160.

Kurnia, T., Nurhaeni, I.D.A. and Putera, R.E., 2022. Leveraging Agile Transformation: Redesigning Local Government Governance. *KnE Social Sciences*, pp.720-733.

La Rose, T. and Detlor, B., 2021. Social Work Digital Storytelling Project: Digital Literacy, Digital Storytelling, and the Makerspace. Research on Social Work Practice, 31(6), pp.599-609.

Lev-On, A., Steinfeld, N., Abu-Kishk, H. and Naim, S.P., 2020. The long-term effects of digital literacy programs for disadvantaged populations: analyzing participants' perceptions. Journal of Information, Communication and Ethics in Society.Vol. 19 No. 1, pp. 146-162.

Marisi, R., 2022. Distance Education Prompted by Covid-19 Lockdowns: A Challenge for Teaching Musical Performing Arts. *Review of Artistic Education*, (23), pp.9-17.

Mathrani, A., Sarvesh, T. and Umer, R., 2021. Digital divide framework: online learning in developing countries during the COVID-19 lockdown. *Globalisation, Societies and Education*, pp.1-16.

McCallum, R.J., Shinn, A.F. and Job, K.A., 1987. Development of a Community Oriented College Level Technological Literacy Course. Bulletin of Science, Technology & Society, 7(3-4), pp.861-867.

Morgan, A., Sibson, R. and Jackson, D., 2022. Digital demand and digital deficit: conceptualising digital literacy and gauging proficiency among higher education students. *Journal of Higher Education Policy and Management*, pp.1-18.

Nes, A.A.G., Steindal, S.A., Larsen, M.H., Heer, H.C., Lærum-Onsager, E. and Gjevjon, E.R., 2021. Technological literacy in nursing education: A scoping review. *Journal of Professional Nursing*, *37*(2), pp.320-334.

Ngubane-Mokiwa, S.A.N. and Tlale, L.D.N., 2015. Promoting Digital Literacy for Children in Conflict with the Law: The Open Distance Learning Potential. *Journal of Social Sciences*, *45*(3), pp.190-198.

Nogueira, V.B., Teixeira, D.G., de Lima, I.A.C.N., Moreira, M.V.C., de Oliveira, B.S.C., Pedrosa, I.M.B., de Queiroz, J.W. and Jeronimo, S.M.B., 2022. Towards an inclusive digital literacy: An experimental intervention study in a rural area of Brazil. *Education and Information Technologies*, *27*(2), pp.2807-2834.

O'Brien, S., McNamara, G., O'Hara, J. and Brown, M., 2022. Learning by doing: Evaluating the key features of a professional development intervention for teachers in data-use, as part of whole school self-evaluation process. *Professional Development in Education*, *48*(2), pp.273-297.

Ogunode, N.J., Ukozor, C.U. and Deborah, J., 2022. Effects of Strike Actions on Nigerian Higher Education Goals and Programme. *European Multidisciplinary Journal of Modern Science*, *6*, pp.1-9.

Ollerenshaw, A., Corbett, J. and Thompson, H., 2021. Increasing the digital literacy skills of regional SMEs through high-speed broadband access. Small Enterprise Research, 28(2), pp.115-133.

Pillai, N.M., Mohan, A., Devika, M., Gutjahr, G. and Nedungadi, P., 2022. Cost-Effectiveness of Using Tablets for Digital Literacy Training in Tribal Areas of Rajasthan. Available at: https://link.springer.com/chapter/10.1007/978-981-16-5689-7_32 (Accessed: 3 June 2022).

Romero-Hall, E. and Jaramillo Cherrez, N., 2022. Teaching in times of disruption: Faculty digital literacy in higher education during the COVID-19 pandemic. *Innovations in Education and Teaching International*, pp.1-11.

Seo, H., Erba, J., Altschwager, D. and Geana, M., 2019. Evidence-based digital literacy class for older, low-income African-American adults. Journal of Applied Communication Research, 47(2), pp.130-152.

Shin, W. and Lwin, M.O., 2022. Parental mediation of children's digital media use in high digital penetration countries: perspectives from Singapore and Australia. *Asian Journal of Communication*, pp.1-18.

Silamut, A.A. and Sovajassatakul, T., 2021. Self-directed learning with knowledge management model on academic achievement and digital literacy abilities for employees of a Thai energy organization. *Education and Information Technologies*, *26*(5), pp.5149-5163.

Smith, A., Rubio-Rico, L., McClelland, G.T., Monserrate-Gómez, S., Font-Jiménez, I. and de Molina-Fernández, I., 2022. Co-designing and piloting an Integrated Digital Literacy and Language Toolkit for vulnerable migrant students in higher education. Education and Information Technologies, pp.1-21.

Suwana, F., 2017. Empowering Indonesian women through building digital media literacy. Kasetsart Journal of Social Sciences, 38(3), pp.212-217.

Temdee, P., 2021. Smart learning environment for enhancing digital literacy of Thai youth: A case study of ethnic minority group. Wireless Personal Communications, 118(3), pp.1841-1852.

Terry, J., Davies, A., Williams, C., Tait, S. and Condon, L., 2019. Improving the digital literacy competence of nursing and midwifery students: A qualitative study of the experiences of NICE student champions. Nurse Education in Practice, 34, pp.192-198.

Terton, U., Greenaway, R., Elsom, S. and Burns, R., 2022. Empowering children through photography and drawing. *Visual Studies*, *37*(1-2), pp.69-83.

Tham, J.C.K., Burnham, K.D., Hocutt, D.L., Ranade, N., Misak, J., Duin, A.H., Pedersen, I. and Campbell, J.L., 2021. Metaphors, mental models, and multiplicity: Understanding student perception of digital literacy. Computers and Composition, 59, pp. 1-30.

Tsai, H.Y.S., Shillair, R. and Cotten, S.R., 2017. Social support and "playing around" an examination of how older adults acquire digital literacy with tablet computers. Journal of Applied Gerontology, 36(1), pp.29-55.

Vimalkumar, M., Singh, J.B. and Sharma, S.K., 2021. Exploring the multi-level digital divide in mobile phone adoption: A comparison of developing nations. *Information Systems Frontiers*, *23*(4), pp.1057-1076.

Weber, H., Hillmert, S. and Rott, K.J., 2018. Can digital information literacy among undergraduates be improved? Evidence from an experimental study. Teaching in Higher Education, 23(8), pp.909-926.

Yakubu, I.W. and Aboho, R.N., 2021. Value orientation as a tool for wiping out corruption in adult and nonformal education in Nigeria. *Nigerian Journal of Curriculum Studies*, *27*(3), pp. 132-138.

Yu, B. and Zadorozhnyy, A., 2022. Developing students' linguistic and digital literacy skills through the use of multimedia presentations. ReCALL, 34(1), pp.95-109.

Yusuf, A., Yusuf, S. and Zayyana, H.M., 2021. Assessment of information security threats to information systems in Federal University Libraries, Nigeria. *Samaru Journal of Information Studies*, *21*(1), pp.38-47.