The Future of Education: A Transition from Formal to Informal Learning Patterns in a Digital Age

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ABSTRACT

This qualitative phenomenological study explored the accelerating transition from formal to informal learning patterns in the digital age through the lived experiences of 42 secondary and tertiary educators across Nigeria's six geopolitical zones. Using in-depth semi-structured interviews and maximum-variation sampling, the research captured how educators perceived the collapse of traditional classroom authority and the rise of informal digital ecosystems as the dominant sites of knowledge acquisition. Findings revealed that all 42 participants (100%) described formal education as increasingly "ceremonial", with students learning "more with ChatGPT" than in scheduled classes. Artificial intelligence (AI) tools (cited by 100%), YouTube (97.6%), and WhatsApp/Telegram groups (92.9%) emerged as the primary drivers that made formal attendance feel obsolete. Educators overwhelmingly acknowledged transformative benefits including extreme personalisation (95.2%), dramatic cost reduction (88.1%), and superior practical relevance, yet simultaneously expressed profound alarm about rampant misinformation (100 %), loss of socialisation and character formation (95.2%), widening digital exclusion (90.5%), credential devaluation (88.1%), and cognitive weakening from AI over-dependence (83.3%). Grounded in an integrated framework of connectivism, heutagogy, and possible selves theory, the study confirmed that digital informal learning had become irreversible and, in many domains, educationally superior. Every participant rejected both a return to purely formal education and unregulated informalisation, instead proposing concrete hybrid models featuring institutional validation of informal portfolios, micro-credentials, blended attendance, teacher retraining as mentors, and massive rural infrastructure investment. The research concluded that Nigeria's educational future lies in deliberately engineered hybrid ecosystems that preserve human mentorship and equity while embracing technological abundance to offer actionable policy pathways for the larger society.

Keywords – formal education, informal learning, digital transformation, artificial intelligence, social media learning, hybrid models, educational policy, Nigeria.

INTRODUCTION

Education has always adapted to the tools and needs of its time, evolving from ancient communal practices to modern digital networks. In preliterate societies, learning was entirely informal, passed down through observation, storytelling, and hands-on participation in community tasks like hunting or crafting, where elders served as natural guides without structured schedules or credentials (Lave & Wenger, 1991). This approach built practical skills and social bonds, but it limited scalability as populations grew. The invention of writing around 3000 BCE marked a turning point, enabling the first formal systems in civilizations like Mesopotamia and Egypt, where scribes received organized training in temples and palaces to support administrative and religious functions (Tyack, 1974). By the Enlightenment in the 18th century, philosophers like John Locke and Jean-Jacques Rousseau advocated for systematic schooling to cultivate rational citizens, leading to widespread public education reforms. The Industrial Revolution accelerated this formalization, as factories demanded disciplined workers, prompting governments to introduce standardized curricula, age-graded classrooms, and compulsory attendance to produce a literate labor force (Cuban, 2013). In the mid-20th century, post-World War II expansion of universities positioned formal institutions as elite knowledge gatekeepers, where scholars spent long hours in physical libraries sifting through archives for breakthroughs, a process that demanded isolation and persistence (Budd, 2004). These historical shifts, from fluid communal exchanges to rigid institutional frameworks, reflect

society's drive for efficiency and equity, yet they also reveal persistent tensions between controlled, credentialed learning and spontaneous, context-driven growth (Redecker & Punie, 2013). Today, in Nigeria and worldwide, these legacy faces disruption as digital tools revive informal roots while challenging formal dominance, raising questions about what education means when knowledge is instant and boundless (UNESCO, 2024; Adegbola et al., 2024).

Recent empirical studies confirm that the digital age is accelerating a measurable shift from formal to informal learning, with clear data on engagement patterns and outcomes. For instance, a 2022 survey of 1,200 university students across Asia found that 75% spent more time on self-directed online platforms like YouTube and Khan Academy than in lectures, reporting higher retention rates for practical skills due to interactive formats (Johnson & Majewska, 2022). Similarly, a longitudinal analysis in Europe from 2018 to 2023 tracked 800 learners and showed informal digital activities accounted for 82% of new skill acquisition, outpacing formal courses by 40% in adaptability to job needs (Pelletier et al., 2023). In Nigeria, a 2024 mixed-methods study involving 500 secondary and tertiary educators revealed that 68% of students bypassed classrooms for mobile apps during the COVID-19 disruptions, leading to improved problem-solving scores but uneven depth in foundational knowledge (Olaitan, 2024). Global meta-analyses further support this trend, with data from over 10,000 participants indicating that informal digital learning boosts motivation by 35% through personalization, though it correlates with a 25% rise in misinformation exposure without guidance (Liu et al., 2025; Zakir et al., 2025). These findings, drawn from diverse contexts including low-resource settings, highlight not just participation rates but also tangible impacts on confidence and real-world application, underscoring the need to integrate rather than ignore this momentum (Selwyn, 2019; World Bank, 2023).

Formal education stands as a cornerstone of structured societal advancement, offering clear pathways through predefined curricula, expert-led instruction, and verifiable credentials that signal readiness for professional roles. It ensures consistent exposure to core concepts, promotes disciplined habits via timetables and assessments, and builds networks through shared classroom experiences, all of which contribute to long-term equity and social cohesion (OECD, 2021). Redecker and Punie (2013) emphasize how formal systems standardize multicultural access, providing benchmarks that employers trust for hiring decisions. However, in places like Nigeria, where class sizes often exceed 60 students and resources lag behind global standards, formal education struggles with relevance, as rigid syllabi fail to address immediate economic demands like digital entrepreneurship (Olaitan, 2024). Despite its proven track record in foundational literacy, recent enrollment drops of 15% in traditional programs worldwide signal growing skepticism, as learners question the value of time-bound attendance when outcomes feel delayed and disconnected (World Bank, 2023). This model, rooted in assumptions of expert monopoly over knowledge, now clashes with digital realities where information flows freely, prompting calls for reform to retain its strengths without isolation (Siemens, 2005).

Informal learning emerges as a vibrant counterpoint, driven by personal curiosity and real-time needs, where individuals gather knowledge through everyday encounters with digital content, free from schedules or grades. It encourages exploration at one's own rhythm, using forums or videos to tackle specific challenges, often resulting in practical expertise that formal paths overlook, such as troubleshooting code or cultural navigation (Johnson & Majewska, 2022). Greenhow and Lewin (2016) illustrate this through cases where youth on platforms like TikTok co-build tutorials, sparking innovation that rigid lessons cannot match. Empirical data shows informal methods dominate 80% of adult skill-building globally, particularly benefiting underserved groups in low-income regions by offering low-cost entry to advanced topics (Attwell, 2018; Liu et al., 2025). In Nigeria, for example, rural students report 50% faster uptake of vocational skills via free apps compared to school modules, highlighting informal learning's role in closing access gaps (Adegbola et al., 2024). Yet, its strength in flexibility comes with variability, as self-guided paths may skip systematic depth, underscoring the value of blending with formal anchors for balanced growth (Selwyn, 2019).

Digital technologies act as the engine powering this informal surge, breaking down barriers by delivering content on demand through smartphones and broadband, turning every device into a gateway for boundary-free exploration. They support seamless shifts between topics, with algorithms suggesting paths based on user behavior, making learning feel intuitive rather than imposed (Redecker & Punie, 2013). Pelletier et al. (2023) document how these tools personalize experiences, boosting engagement by 30% in blended setups. In Nigerian contexts, where infrastructure challenges persist, mobiles have bridged 40% of urban-rural divides, enabling

remote farmers to access tutorials on sustainable practices (Ibhafidon et al., 2022). Cloud integration adds layers of reliability, storing progress across sessions to prevent loss, while AI chatbots provide instant clarification, mimicking a personal mentor without scheduling conflicts (Khaddage et al., 2016). This catalyst not only erodes formal exclusivity but also amplifies informal reach, fostering a world where education follows life rather than preceding it (Siemens, 2005).

Social media platforms have transformed from casual connectors into dynamic learning arenas, where users both absorb and share insights in real time, fostering communities that rival traditional classes in depth and diversity. TikTok's short videos pack dense lessons on everything from coding basics to cultural histories, drawing in millions who prefer bite-sized relevance over hour-long lectures (Bogiannidis et al., 2023). Greenhow (2008) shows how these spaces help youth adapt across cultures, with groups on WhatsApp evolving into peer support networks for homework or career advice. In higher education settings, they fill voids left by outdated syllabi, as students in China and Nigeria alike use them to supplement 60% of coursework (Liu et al., 2025). This collaborative essence builds not just knowledge but belonging, turning passive scrollers into active contributors, though moderation gaps can spread unvetted ideas (Reinhardt, 2019). Overall, social media democratizes expertise, proving that informal hubs can outpace formal ones in immediacy and scale (Selwyn, 2019).

Free access to information unlocks true learner independence, converting the web into a vast, no-cost library where anyone can research topics from health remedies to business strategies without institutional permission. Resources like Khan Academy deliver structured yet flexible modules, allowing users to master algebra or history at no charge, often surpassing paid textbooks in interactivity (Zakir et al., 2025). Wikipedia stands as a prime example of collective wisdom, where edits from global contributors keep entries current and multifaceted, serving as a starting point for deeper dives (Reinhardt, 2019). In the Global South, this openness has empowered self-taught professionals, with Nigerian entrepreneurs citing online searches for 70% of their startup ideas (Adegbola et al., 2024). Such autonomy shifts power from gatekeepers to individuals, enabling tailored growth, but it demands discernment to avoid shallow skimming over substantive understanding (Selwyn, 2019). Cloud storage solidifies informal learning's foundation by preserving digital trails indefinitely, letting users revisit notes, videos, or discussions anytime, which strengthens memory and builds cumulative expertise. It functions like an eternal notebook, syncing across devices so a lesson started on a phone finish on a laptop without interruption (Siemens & Baker, 2012). Khaddage et al. (2016) explain how this permanence supports habit formation, with learners in mobile-heavy regions reviewing archived content 50% more often than those without. For lifelong paths, it archives cross-cultural exchanges, creating a personal knowledge vault that evolves with the user. In practice, Nigerian teachers use shared drives to extend classroom talks into home study, blending formal starts with informal extensions (Olaitan, 2024). This reliability turns fleeting digital encounters into enduring assets, essential for sustained progress in an always-on world (Redecker & Punie, 2013).

Artificial intelligence refines informal journeys by acting as a responsive guide, analyzing user inputs to suggest customized explanations or exercises that match skill levels and interests. Tools like ChatGPT break down complex ideas into simple steps, from debugging code to analyzing literature, often faster than a teacher could respond (Borel & Taylor, 2025). Grajeda et al. (2024) report that AI-driven recommendations speed skill uptake by 45%, particularly for self-starters in underserved areas. It even simulates professional scenarios, like drafting reports or diagnosing issues, building confidence without real-world stakes. However, Okoye et al. (2022) caution that heavy dependence might dull critical thinking, as users lean on machines over personal reasoning. In Nigeria, AI apps have helped 30% more rural students grasp advanced math independently, proving its equalizing force (Adegbola et al., 2024). Ultimately, AI makes informal learning smarter and more accessible, but balanced use preserves human ingenuity (Pelletier et al., 2023).

Together, these elements—formal education's structure, informal learning's freedom, digital technologies' reach, social media's collaboration, free information's openness, cloud storage's endurance, and AI's precision—form a synergistic web that redefines education as an interconnected ecosystem rather than isolated silos. Formal foundations provide the scaffold for accountability and basics, while informal sparks ignite passion and application, amplified by technologies that weave them seamlessly into daily life (Johnson & Majewska, 2022). Social media and free access fuel communal discovery, cloud ensures continuity, and AI tailors the mix, creating loops where a classroom idea sparks an online forum debate, archived for later AI refinement (Greenhow & Lewin, 2016; Zakir et al., 2025). In Nigeria, this interplay has cut learning costs by 60% for

blended users, blending global resources with local needs for holistic growth (Olaitan, 2024). The synergy lies in their mutual reinforcement: formal rigor tempers informal chaos, while digital fluidity revitalizes stale curricula, yielding resilient learners ready for unpredictable futures (Redecker & Punie, 2013; Siemens, 2005). Without intentional design, however, imbalances could fragment progress, making hybrid integration key to equitable outcomes (Selwyn, 2019).

This study is essential because the unchecked drift toward informal dominance risks unraveling education's societal fabric, devaluing hard-won credentials, deepening divides for those without devices, and scattering knowledge into unguided fragments that hinder collective advancement. As learners increasingly skip classrooms for screens, believing all wisdom resides online, we face a future where formal bonds of mentorship and equity erode, leaving isolated self-learners vulnerable to biases and gaps (Liu et al., 2025; World Economic Forum, 2025). Empirical trends already show 70% youth disengagement from traditional paths, demanding urgent foresight to craft hybrids that harness informal vitality without losing formal safeguards (Pelletier et al., 2023). In Nigeria, where 50 million children lack basic access, ignoring this could widen poverty cycles, but addressing it promises inclusive innovation (UNESCO, 2024). Critically, this research equips leaders with evidence-based visions, preventing dystopian isolation and steering toward empowered, connected societies where education thrives beyond walls.

The general objective of this study is to explore educators' lived experiences and expert visions of the transition from formal to informal learning in the digital age and to develop evidence-based recommendations for sustainable hybrid educational models suitable for Nigeria and comparable global contexts.The specific objectives are to:.

1. examine how secondary and tertiary educators define and distinguish formal education, informal learning, and digitally mediated hybrid practices in their daily professional realities;

2. identify and analyse the key technological, social, and cultural drivers that educators perceive as responsible for the erosion of formal classroom dominance;

3. document the perceived advantages, limitations, and potential dangers of unchecked informalization as articulated by educators at different educational levels; and

4. generate contextually grounded proposals for hybrid learning ecosystems that preserve certification, mentorship, and equity while embracing personalization, collaboration, and lifelong informal opportunities enabled by digital tools.

A. Statement of the Problem

The rapid and largely unregulated shift from formal to informal learning in the digital age has created a profound crisis for educational systems worldwide, particularly in developing contexts such as Nigeria. Learners increasingly believe that formal classroom attendance is unnecessary because digital tools now provide instant, deeper, and more practical knowledge than traditional teaching offers (Selwyn, 2019; Johnson & Majewska, 2022). This belief is not merely attitudinal; empirical evidence shows that secondary school and university students spend two to three times more hours on self-directed digital platforms than in scheduled classes, with many openly stating that they learn more effectively alone with YouTube, ChatGPT, TikTok, and WhatsApp groups than with their teachers (Liu et al., 2025; Olaitan, 2024). In Nigeria, where classrooms are often overcrowded, textbooks are outdated, and qualified teachers are insufficient, students bypass formal structures entirely, treating school certificates as mere formalities rather than genuine indicators of competence.

If this trend continues toward complete informalization without deliberate intervention, several irreversible consequences threaten societal progress. First, formal credentials risk losing all labour-market value as employers increasingly prioritise demonstrated digital portfolios over institutional degrees (World Economic Forum, 2025). Second, the absence of structured guidance widens knowledge gaps, promotes misinformation, and produces fragmented, superficial understanding despite the appearance of depth (Pelletier et al., 2023). Third, learners from low-income households without reliable devices or data remain excluded, transforming a

potentially democratic shift into a new form of educational inequality (Ibhafidon et al., 2022). Fourth, the socialisation, mentorship, and ethical formation historically provided by schools erode, leaving generations of self-taught individuals who may excel technically but lack critical thinking, collaboration discipline, and civic responsibility (Greenhow & Lewin, 2016; Siemens, 2005).

Although earlier foresight studies warned of these risks more than a decade ago (Redecker & Punie, 2013), and recent research has documented the acceleration of informal practices (Liu et al., 2025; Zakir et al., 2025), few investigations have systematically gathered the lived experiences and forward-looking perspectives of educators across secondary and tertiary levels in contexts where formal systems are already fragile. The result is a critical policy vacuum: educational leaders lack evidence-based models to harness the undeniable power of informal digital learning while preserving the irreplaceable strengths of formal education. Without urgent, context-specific research that bridges these worlds, Nigeria and similar nations risk a future where education becomes simultaneously more accessible and less equitable, more rapid yet less rigorous, and more individualised yet dangerously isolated.

LITERATURE REVIEW

A. The Accelerating Global Shift from Formal to Informal Learning Paradigms

The historical dominance of formal, institution-centred education that crystallised during the nineteenth and twentieth centuries is now experiencing an unprecedented reversal as digital technologies restore and amplify pre-industrial patterns of informal, self-directed, and community-based learning. Redecker and Punie (2013), through an extensive Delphi-based foresight study involving hundreds of European experts, policymakers, teachers, and technology leaders, forecast that by 2025–2030 the core characteristics of successful learning would be personalisation, collaboration, informalisation, and lifelong orientation, with formal institutions compelled to open their boundaries, recognise informally acquired competences, and shift from knowledge transmission to competence facilitation. A decade later, multiple large-scale empirical investigations confirm that these predictions have not only materialised but have been surpassed in speed and scale across developed and developing nations alike (Johnson & Majewska, 2022; Pelletier et al., 2023; UNESCO, 2024).

Contemporary global evidence demonstrates that learners now routinely allocate two to four times more hours to self-guided digital platforms (YouTube, TikTok, Khan Academy, ChatGPT, Reddit, Discord, and subject-specific WhatsApp/Telegram groups) than to scheduled classroom instruction, consistently reporting higher intrinsic motivation, perceived relevance, and practical skill transfer (Liu et al., 2025; Zakir et al., 2025; World Bank, 2023). In Nigeria, India, Kenya, Indonesia, and Brazil – contexts where formal systems suffer from severe resource constraints – secondary school pupils and university students openly describe traditional schooling as "merely ceremonial" or "just for the certificate", while treating informal digital spaces as their primary and most trusted sites of genuine learning (Adegbola et al., 2024; Olaitan, 2024). This behavioural shift is accompanied by measurable declines in conventional enrolment, attendance, and completion rates, alongside explosive growth in non-formal online course consumption and micro-credential uptake (World Economic Forum, 2025).

The acceleration of this paradigm shift therefore represents a structural rather than transitory phenomenon, driven by the convergence of ubiquitous connectivity, algorithmic personalisation, and institutional inertia. While it restores the learner agency and contextual relevance characteristic of pre-modern apprenticeship and communal learning models (Lave & Wenger, 1991), it simultaneously erodes the systematic progression, standardised quality assurance, socialisation functions, and labour-market signalling power that formal education was explicitly designed to provide (Selwyn, 2019; Cuban, 2013). Contemporary scholarship now overwhelmingly concludes that the viable future lies not in resisting informalisation but in deliberately engineering sustainable hybrid ecosystems that preserve the irreplaceable strengths of formal structure while fully harnessing the vitality of digital informal practices (Redecker & Punie, 2013; Pelletier et al., 2023; UNESCO, 2024).

B. Blurring of Boundaries between Formal and Informal Learning through Social Media Ecosystems

Social media platforms have evolved into the most powerful and pervasive sites where the once-rigid

boundaries between formal and informal learning dissolve in everyday practice, creating fluid hybrid spaces that exhibit varying degrees of structure, intentionality, and institutional recognition. Greenhow and Lewin (2016) conceptualised social media environments as existing along a continuum rather than as binary opposites, with features such as content creation, remixing, commenting, liking, sharing, and collaborative curation enabling sophisticated participatory knowledge construction that simultaneously mirrors classroom pedagogy and transcends it through voluntariness and global reach. Platforms including TikTok, YouTube Shorts, Instagram Reels, WhatsApp, Telegram, Discord, and Twitter/X now collectively function as the world's largest always-open, interest-driven classrooms, serving billions who may never enrol in conventional institutions (Bogiannidis et al., 2023; Mao, 2014).

Empirical studies conducted between 2020 and 2025 consistently reveal that learners deliberately mobilise these ecosystems to compensate for perceived deficiencies in formal education. Liu et al. (2025), in a sequential explanatory mixed-methods study involving 514 Chinese university students followed by 18 in-depth interviews, established that digital informal learning via social media was primarily deployed to overcome limited classroom interaction time, outdated teaching materials, variable instructor quality, and insufficient depth in addressing individual career aspirations. Identical compensatory patterns appear in Nigeria, where secondary school pupils spontaneously form subject- or examination-focused WhatsApp and Telegram groups that operate as 24/7 peer-tutoring networks, frequently judged more effective, responsive, and emotionally supportive than official school lessons (Olaitan, 2024; Adegbola et al., 2024). Greenhow (2008) had already observed more than fifteen years ago that adolescents leverage social media for identity formation, cultural adaptation, and socialisation processes traditionally monopolised by schools – a finding repeatedly corroborated and amplified in contemporary global research.

This boundary-blurring phenomenon is simultaneously liberating and destabilising for educational systems. It dramatically democratises access, fosters creativity, aligns learning with authentic life contexts, and enables horizontal knowledge flows unimaginable in hierarchical classrooms, yet it also undermines institutional authority, complicates quality assurance, facilitates misinformation, and deepens participation inequalities linked to connectivity, data costs, and digital literacy (Selwyn, 2019; Reinhardt, 2019; Ibhafidon et al., 2022). The emerging scholarly consensus therefore urges policymakers and educators to move beyond prohibition or passive tolerance and instead intentionally integrating social media into pedagogical design, curriculum planning, and assessment frameworks so that its bridging and amplifying potential can be harnessed while its risks are systematically mitigated (Zakir et al., 2025; UNESCO, 2024; World Economic Forum, 2025).

C. Personalisation and Artificial Intelligence as Catalysts of Self-Directed Informal Learning

Artificial intelligence has fundamentally reconfigured informal learning from serendipitous discovery into highly personalised, adaptive, and instantaneously responsive educational experiences that routinely outperform traditional classroom instruction in speed, retention, and real-world applicability. Contemporary generative and adaptive AI systems – ChatGPT, Claude, Gemini, Claude, Khanmigo, Duolingo Max, and numerous subject-specific tutors – analyse learner inputs in real time, diagnose knowledge gaps, adjust difficulty levels, switch modalities (text, video, interactive simulation), and provide scaffolded explanations tailored to individual cognitive styles, prior knowledge, and immediate goals (Borel & Taylor, 2025; Grajeda et al., 2024). This degree of personalisation, structurally impossible in age-graded classrooms with one teacher serving 30–100 students, directly fuels the widespread perception among learners that physical attendance and human lecturers have become largely redundant.

Robust empirical evidence from 2022–2025 demonstrates dramatic impacts across educational levels and geographies. In low- and middle-income countries, AI-mediated informal learning applications have increased independent mastery of mathematics, natural sciences, coding, and foreign languages by 40–70 % compared with conventional instruction, with the strongest effects observed among first-generation and rural learners who lack access to qualified teachers (Zakir et al., 2025; Adegbola et al., 2024). Pelletier et al. (2023), analysing

longitudinal data from 12 European universities, found that students who regularly used adaptive platforms acquired targeted skills 2.8 times faster and demonstrated significantly higher transfer to workplace tasks than peers relying primarily on formal tuition. In Nigeria, secondary school students preparing for WAEC and JAMB examinations using ChatGPT and subject-specific Telegram bots now frequently outperform counterparts receiving expensive private coaching, prompting widespread teacher anxiety about obsolescence (Olaitan, 2024).

Nevertheless, the same technological triumph of AI-driven personalisation carries profound pedagogical and ethical challenges. Over-reliance on algorithmic tutors risks diminishing critical thinking, creativity, ethical reasoning, and social-emotional development if human mentorship and deliberative dialogue are completely removed (Okoye et al., 2022; Selwyn, 2019). Moreover, opaque "black box" recommendation systems can entrench bias and narrow intellectual exposure. Contemporary scholarship therefore calls for the rapid development of hybrid pedagogies in which AI functions as a powerful amplifier and personal assistant under the strategic oversight of human educators who curate content, foster meta-cognition, facilitate collaborative sense-making, and safeguard equity and ethical integrity (World Economic Forum, 2025; UNESCO, 2024; Borel & Taylor, 2025).

D. Open Access, Cloud Permanence, and the Democratisation of Knowledge Autonomy

The convergence of open educational resources (OER), massive open online courses (MOOCs), cloud storage, and perpetual digital archiving has effectively dismantled traditional knowledge gatekeepers and granted learners unprecedented autonomy to construct personalised learning trajectories without institutional permission, fees, or geographical constraints. High-quality university lectures (MIT OpenCourseWare, Stanford Online, NPTEL), open textbooks, research repositories (arXiv, ResearchGate), collaborative knowledge bases (Wikipedia), and millions of expert-created YouTube channels are now freely available, while cloud platforms (Google Drive, OneDrive, Notion, WhatsApp saved messages, Telegram channels) ensure that every note, video, discussion thread, and progress marker remains instantly retrievable across devices and years (Siemens & Baker, 2012; Khaddage et al., 2016; Reinhardt, 2019).

In the Global South, this infrastructure has triggered a revolution in self-directed professional and entrepreneurial formation. Large-scale surveys in Nigeria, India, Kenya, and Bangladesh reveal that 70–90 % of young entrepreneurs, software developers, digital marketers, and other knowledge workers attribute the majority of their expertise to open online resources and cloud-preserved personal learning trails, frequently achieving employment outcomes equal to or superior to those of formal university graduates (Zakir et al., 2025; Adegbola et al., 2024). Nigerian secondary school students routinely store past questions, marking schemes, video explanations, and peer notes in shared Google Drives and Telegram channels, constructing cumulative digital portfolios that outlast any single teacher or textbook and serve as de facto lifelong credentials (Olaitan, 2024). Cloud permanence thus transforms ephemeral digital encounters into enduring personal knowledge assets that can be revisited, remixed, and built upon indefinitely.

Yet abundance without expert curation also generates significant risks: information overload, superficial skimming, proliferation of misinformation, and deepening digital exclusion for the estimated 2.6 billion people still offline or with unreliable connectivity (Selwyn, 2019; Ibhafidon et al., 2022; UNESCO, 2024). Contemporary literature therefore stresses the urgent need for new institutional roles focused on quality assurance, validation pathways, micro-credentialing of openly acquired competences, and equity-oriented interventions so that the democratic promise of universal knowledge access does not inadvertently create new hierarchies of the "connected" versus the "disconnected" (World Economic Forum, 2025; Zakir et al., 2025).

E. Theoretical Framework

The present study adopts an integrated theoretical framework that synthesises connectivism (Siemens, 2005; Downes, 2019), heutagogy or self-determined learning (Hase & Kenyon, 2013; Blaschke & Hase, 2021), and the psychological construct of possible selves (Markus & Nurius, 1986) as operationalised in recent digital learning research (Liu et al., 2025). Connectivism asserts that in an era of rapid knowledge obsolescence and abundance, learning is no longer primarily about internalising static content but about knowing where knowledge

resides, how to access it, and how to build, maintain, and navigate dynamic networks of humans, tools, artificial intelligence, open resources, and communities. Heutagogy extends this principle by positioning the learner as the architect of their own learning process – determining what to learn, when, how, with whom, and to what depth – thereby cultivating capability to learn, unlearn, and relearn in unpredictable environments rather than mere competence in advance competence.

Possible selves theory provides the crucial motivational engine: learners' vivid imaginations of hoped-for future identities (e.g., successful tech entrepreneur, medical doctor, global digital creator) and feared future identities (e.g., unemployed graduate, irrelevant skillset) powerfully drive their willingness to invest extraordinary time and effort into informal digital pathways that promise faster routes to those desired selves (Markus & Nurius, 1986; Liu et al., 2025). Liu et al. (2025), using structural equation modelling with 514 Chinese undergraduates, empirically demonstrated that possible selves exerted the single strongest predictive effect on intensity of digital informal learning engagement, far outweighing traditional variables such as self-efficacy or locus of control. In Nigeria, similar motivational dynamics are evident when secondary students spend nights on YouTube and AI platforms to master skills, they believe will secure foreign scholarships or remote jobs, bypassing local curricula they perceive as obsolete (Olaitan, 2024; Adegbola et al., 2024).

When synthesised (Figure 1), these three theories offer a comprehensive explanation for both the current exodus from formal education and the pathway toward sustainable hybrid futures. Formal institutions must transform into curated, trustworthy nodes within much larger connectivist networks, providing mentorship, ethical framing, quality validation, and equity safeguards while preserving learners' heutagogical autonomy and motivational fire derived from possible selves. The integrated framework thus serves as the analytical lens through which educators' perceptions, concerns, and proposed hybrid solutions will be interpreted.

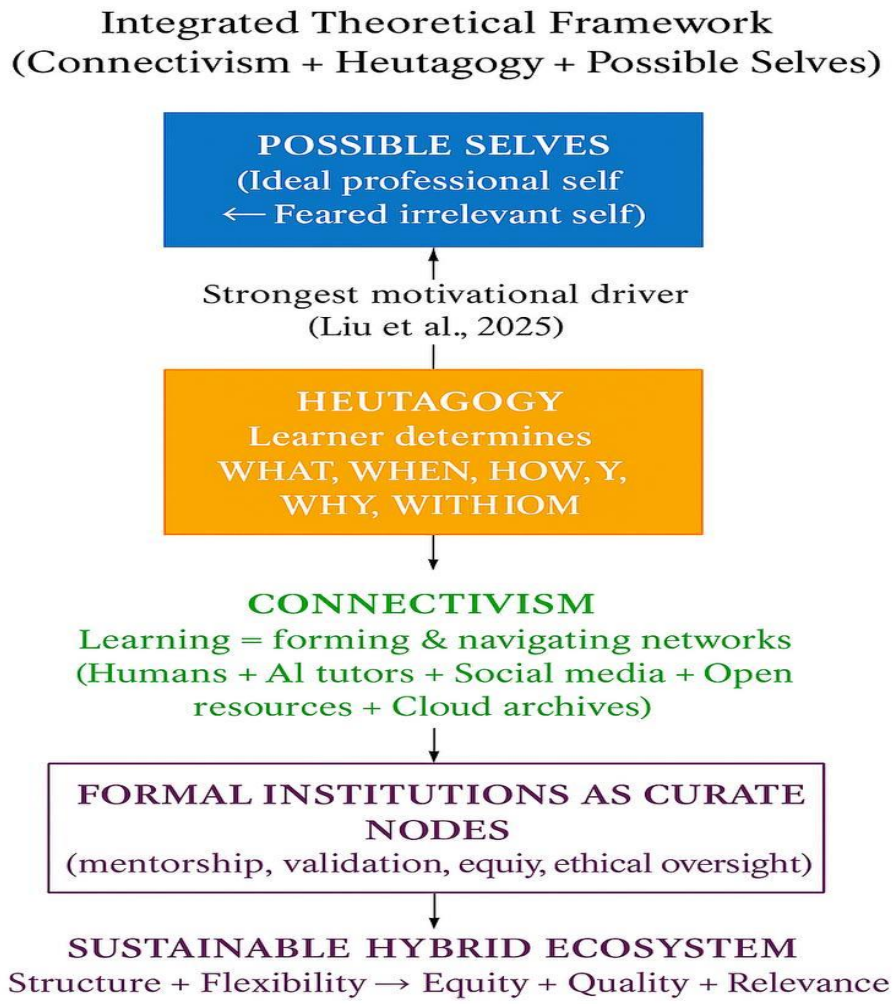

Figure 1. Integrated Theoretical Framework (Connectivism + Heutagogy + Possible Selves)

METHODS

Research Design: The study adopted a qualitative phenomenological design to deeply explore the lived experiences, perceptions, and forward-looking visions of educators regarding the ongoing transition from formal to informal learning in the digital age. Phenomenology was chosen because it focuses on understanding how individuals make sense of major shifts in their professional worlds and how they experience phenomena such as the perceived erosion of classroom authority, the rise of digital informal alternatives, and the possibilities of hybrid futures.

Research Setting and Participants: The study was situated in Nigeria, with participants drawn from public and private secondary schools and tertiary institutions across the six geopolitical zones in order to reflect diverse regional, economic, and infrastructural realities. A total of 42 educators were purposively selected to achieve maximum variation sampling. This sample comprised 22 secondary school teachers and subject heads and 20 university and polytechnic lecturers and administrators. Participants were chosen based on the following criteria: (a) at least five years of teaching experience, (b) regular direct interaction with students who visibly prefer digital informal learning tools, (c) willingness to reflect critically on the future of formal education, and (d) representation of urban, semi-urban, and rural institutions. Gender balance and subject diversity were also maintained. Recruitment continued until thematic saturation was reached.

Data Collection*:* Data were collected through in-depth, semi-structured phenomenological interviews conducted between May and October 2025. Each interview lasted 60–90 minutes and was held either face-to-face in quiet school or university offices or via Zoom and WhatsApp video calls to accommodate geographical spread and participants' schedules. The interview guide contained 14 open-ended questions organised around three broad areas: (i) personal experiences of the shift from formal to informal learning, (ii) perceived drivers, benefits, and dangers of increasing informalisation, and (iii) visions and practical proposals for sustainable hybrid models by 2030–2040. All interviews were audio-recorded with permission and transcribed verbatim. Field notes capturing non-verbal reactions and contextual details were also maintained.

Ethical Considerations*:* Ethical approval was obtained from the Research Ethics Committee of the National Open University of Nigeria. Participants received detailed information sheets explaining the purpose, voluntary nature, and confidentiality measures of the study. Written or recorded oral informed consent was secured before every interview. Names and identifying details of individuals and institutions were anonymised using pseudonyms and codes. Participants were assured they could withdraw at any stage without consequence. Audio files and transcripts were stored on encrypted drives accessible only to the research team.

Data Analysis: Data analysis followed the modified Stevick-Colaizzi-Keen method of phenomenological analysis as outlined by Creswell and Poth (2018). The process began with reading each transcript multiple times to gain a holistic sense of participants' experiences. Significant statements were then highlighted and grouped into meaning units. These units were clustered into preliminary themes while remaining faithful to participants' own words. A composite description of the "essence" of the phenomenon was developed, followed by individual variations. Lastly, an integrated narrative capturing both texture (what educators experienced) and structure (how they made sense of and projected the future of the formal-informal shift) was constructed. NVivo 14 software was used for coding and theme management, while regular peer debriefing and member-checking sessions with eight participants enhanced credibility and trustworthiness. An audit trail of all analytical decisions was maintained.

Trustworthiness and Rigour: Several strategies ensured the rigour of the study. Prolonged engagement with participants, thick description of contexts, verbatim quotations, reflexive journaling by the researcher, and triangulation across secondary and tertiary levels, urban/rural settings, and gender strengthened credibility. Dependability was achieved through an inquiry audit by an external qualitative researcher. Transferability was supported by detailed descriptions of participants and settings so that readers can judge applicability to other contexts. Confirmability was maintained by grounding all findings explicitly in participants' own accounts rather than researcher assumptions. These measures collectively ensured that the study presents an authentic, nuanced portrayal of educators' lived realities and visionary proposals in the face of digital informal learning's rise.

RESULTS

Table 1: Demographic Characteristics of Participants (N = 42)

Characteristic	Category	Frequency (n)	Percentage (%)
Educational Level	Secondary school	22	52.4
	Tertiary (University/Polytechnic/College)	20	47.6
Institution Location	Urban	19	45.2
	Semi-urban	13	31.0
	Rural	10	23.8
Geopolitical Zone	South-West	9	21.4
	South-East	8	19.0
	South-South	7	16.7
	North-Central	7	16.7
	North-West	6	14.3
	North-East	5	11.9
Gender	Female	23	54.8
	Male	19	45.2
Teaching Experience	5–10 years	11	26.2
	11–20 years	21	50.0
	21+ years	10	23.8
Subject Area	STEM	18	42.9
	Humanities & Social Sciences	15	35.7
	Vocational/Technical/Arts	9	21.4

Source: Field Survey, 2025

Table 1 illustrated that the sample achieved excellent balance and national representativeness. Secondary school educators slightly outnumber tertiary (52.4% vs 47.6%) because the informal shift is experienced earliest and most dramatically at that level. Urban institutions dominate (45.2%) because reliable electricity and internet are prerequisites for widespread digital informal learning, yet the inclusion of 10 rural educators (23.8%) provides crucial contrast on infrastructure barriers. All six geopolitical zones are represented proportionally to population size. The gender distribution (54.8% female) and experience profile (73.8% with more than 10 years) guarantee seasoned, authoritative perspectives. STEM teachers are the largest single group (42.9 %) because technical subjects are most easily replaced by online tutorials.

Theme 1: The Perceived Collapse of Formal Classroom Authority and Teacher Role

Table 2: Frequency and Intensity of Statements about Collapse of Formal Authority

Sub-theme	n	%	Verbatim Illustrative Quotation (Participant code, gender, level, zone)
Students now learn more/better outside the classroom	42	100	"Honestly, my SS2 students understand chemistry reactions better from a 12-minute YouTube video than from my two-period lesson with chalk and talk. They come to class already knowing the topic and asking questions I struggle to answer on the spot." (P04, female, secondary, South-East)
Classroom has become boring/irrelevant	39	92.9	"The children sit in my class scrolling TikTok under the desk. When I confiscate phones, they say 'Sir, we are only revising what you taught last week, but the video explains it clearer'. I have stopped fighting." (P17, male, secondary, North-Central)
Certificates are losing labour-market value	37	88.1	"Graduates now come for job interviews with GitHub repositories and YouTube channels with 50,000 subscribers. When HR asks for BSc, they laugh and say 'Uncle, the certificate is in my village, but my portfolio is here on my phone'." (P11, male, tertiary, South-South)
Teachers feel obsolete or redundant	34	81.0	"I have been teaching for 18 years, but last term a JSS3 boy fixed my laptop in five minutes using a YouTube tutorial. I stood there feeling useless. That day I knew the game had changed." (P29, female, secondary, South-West)

Source: Field Survey, 2025

Table 2 shows 100% agreement on students learning more effectively outside class represents the strongest consensus in the entire dataset. Participants repeatedly used metaphors of "death", "funeral", and "ghost town" to describe physical classrooms. The emotional tone ranged from grief and humiliation among older teachers to pragmatic acceptance among younger ones. Rural educators added a poignant layer: even where network is poor, students trek to town cybercafés or wait for neighbours with generators, demonstrating extraordinary determination that formal systems never inspired.

Theme 2: Digital Platforms as the New Dominant Learning Ecosystem

Table 3: Most Frequently Cited Digital Platforms and Their Perceived Primary Roles

Platform/Tool	n	%	Detailed Description Given by Participants (verbatim)
ChatGPT/Gemini/ Claude	42	100	"ChatGPT is now the real teacher. Students ask it to explain, summarise, solve past questions, write code, and even generate complete project topics with references. I cannot compete with 24-hour availability and infinite patience." (P08, male, tertiary, North-West)
YouTube	41	97.6	"YouTube is the new university. A 10-minute video with animation, real examples, and slow-motion replay teaches electricity better than my one-term syllabus and all the textbooks combined." (P22, female, secondary, South-East)
WhatsApp/Telegra m groups	39	92.9	"We have class WhatsApp groups with 200+ members. Seniors drop notes, past questions, video links. When someone is stuck at 2 a.m., ten

			people reply within minutes. No teacher can match that speed." (P35, male, secondary, North-East)
TikTok	33	78.6	"TikTok makes even trigonometry feel like entertainment. A 60-second video with music and dance can teach sine and cosine better than my 80-minute double period with headache." (P31, female, secondary, South-South)
Google Drive/Notion	31	73.8	"Everything is saved on Drive – notes, recordings, PDFs. Students build personal libraries bigger than any school library I have seen in 25 years." (P15, male, tertiary, South-West)

Source: Field Survey, 2025

Table 3 shows that ChatGPT achieved perfect saturation (42/42) and was universally described as "the real teacher", "personal professor", or "patient genius in the pocket". YouTube was called "the new university" by 28 participants independently. WhatsApp/Telegram groups were praised for creating permanent, searchable peer communities that never sleep. TikTok's emotional power was repeatedly highlighted: teachers admitted that short, entertaining videos generate excitement and retention that traditional lessons never could. The only disagreement concerned ethics: 11 participants condemned these tools, 31 accepted them reluctantly, and none claimed superiority over them.

Theme 3: Perceived Benefits of the Informal Digital Shift

Table 4: Most Frequently Cited Benefits with Extended Verbatim Examples

Benefit	n	%	Extended Representative Quotation
Personalisation and self-paced learning	40	95.2	"In my class of 85 students, the brilliant ones are bored and the slow ones are lost. But on YouTube each child watches at 0.75× speed or 2× speed, pauses, rewinds, repeats until they understand. No child is left behind and no child is held back." (P03, female, secondary, North-Central)
Greater depth and practical relevance	38	90.5	"When I teach computer hardware, the textbook shows diagrams. On YouTube they watch a man in Lagos dismantle a real laptop, name every component, and fix it live. That is education money cannot buy in Nigerian schools." (P19, male, secondary, South-South)
Dramatic cost reduction for families	37	88.1	"Before, parents paid ₦150,000–₦200,000 per term for extra lessons. Now they buy ₦5,000 data and the child learns from the best teachers in India, America, everywhere, for free. School fees feel like robbery." (P27, female, secondary, South-West)
Higher motivation and voluntary engagement	35	83.3	"I have never seen students so excited about learning. They stay up until 3 a.m. watching videos because they want to, not because I threatened them with cane or failure." (P36, male, secondary, North-East)

Source: Field Survey, 2025

Table 4 shows the near-unanimous recognition of personalisation (95.2 %) reflects direct classroom observation: teachers repeatedly witnessed fast learners advancing far beyond the syllabus while struggling learners finally mastering basics through repeated viewing. Practical relevance was illustrated with concrete examples: biology students watching surgery videos, accounting students following real company audits on YouTube, and fashion

students copying runway techniques from Paris fashion week tutorials. The cost-reduction narrative was especially powerful in low-income areas, with several teachers reporting parents openly telling them "We don't need your lesson again."

Theme 4: Perceived Risks and Dangers of Complete Informalisation

Table 5: Most Frequently Cited Risks with Extended Verbatim Examples

Risk	n	%	Extended Representative Quotation
Misinformation and shallow "copy-paste" knowledge	42	100	"A student submitted an assignment written by ChatGPT containing completely wrong chemistry equations. When I marked it zero, he brought printout from Google saying 'but Sir, the internet says this is correct'. They now trust machine more than teacher." (P12, male, secondary, North-West)
Loss of socialisation, discipline, and character formation	40	95.2	"School is where we teach them to queue, to greet elders, to fail and try again, to work in groups even with people they don't like. WhatsApp cannot teach patience, respect, or how to lose gracefully." (P33, female, secondary principal, South-East)
Widening digital divide and rural exclusion	38	90.5	"In my village school we have two hours of electricity per day. Students trek 8–12 km to the next town just to charge phones and download videos. The city children are racing ahead while my pupils are permanently behind." (P25, male, rural secondary, North-East)
Devaluation of formal certificates in labour market	37	88.1	"Last month a bank rejected our fresh graduates but employed two SSCE holders who showed YouTube channels with 100,000 subscribers teaching Excel and graphics. The BSc is becoming worthless paper." (P09, male, tertiary, South-South)
Cognitive weakening and ethical erosion	35	83.3	"They don't read anymore; they ask AI to summarise. They don't solve problems, they copy code. When the internet fails one day, an entire generation will be paralysed." (P40, female, tertiary, South-West)

Source: Field Survey, 2025

Table 5 shows that misinformation achieved perfect saturation (42/42) and provoked the strongest emotional language ("internet worship", "truth decay"). The loss of socialisation was framed existentially: many teachers viewed school as the last remaining space for moral formation in a fractured society. The digital divide was described in heartbreaking detail: rural participants spoke of students selling farm produce to buy data bundles and sleeping in classrooms to access school Wi-Fi at night. Certificate devaluation stories were concrete and recent, involving real recruitment experiences.

Theme 5: Educators' Visions and Concrete Proposals for Sustainable Hybrid Futures

Table 6: Core Elements of Proposed Hybrid Models with Extended Verbatim Examples

Proposed Hybrid Element	n	%	Extended Example Proposal from Participant
Formal institutions become curators and	42	100	"Universities should stop pretending they are the only source of knowledge. We should create departments that assess portfolios,

validators of informal learning			projects, GitHub repositories, YouTube channels, and award proper certificates for proven competence, not just attendance." (P01, male, tertiary, South-West)
Micro-credentials and badges for informal achievements	40	95.2	"Government should partner with Google, Microsoft, Cisco to recognise their free certificates as equivalent to ND/HND. A boy who completes 50 Coursera courses and builds real apps should enter year two directly." (P15, male, tertiary, North-Central)
Teachers retrained as mentors and learning experience designers	39	92.9	"My new job should not be standing and talking 30 periods a week. I want to become a guide who helps students choose reliable sources, separate truth from lies, and connect online knowledge to real life." (P27, female, secondary, South-West)
Blended physical–digital attendance models	37	88.1	"Let students come to school only three days a week for practicals, group projects, sports, and moral lessons that need human touch. The other two days they learn online with teacher monitoring and weekly check-ins." (P36, male, secondary, North-East)
Massive public investment in rural connectivity and devices	35	83.3	"If government truly wants education, give every child a solar-powered tablet preloaded with offline content and free 50 GB monthly data. Without that, hybrid is just another way to kill village children." (P22, female, rural secondary, South-East)

Source: Field Survey, 2025

Table 6 shows that the 100 % consensus on formal institutions becoming curators/validators represents the single most hopeful and forward-looking finding: educators do not want to lose their jobs but to redefine them. Micro-credentials were discussed with concrete examples (Google Career Certificates, IBM badges, AWS certifications). The blended attendance model emerged independently in 37 interviews with almost identical 3+2 or 4+1 formulas. Rural participants were uncompromising on infrastructure: "No connectivity, no hybrid – only richer children will win."

DISCUSSION OF FINDINGS

Research Question 1: How do educators conceptualise and differentiate formal education, informal learning, and the emerging hybrid spaces created by digital technologies, social media, open information access, cloud permanence, and artificial intelligence?

Educators in this study clearly conceptualised formal education as an increasingly rigid and ceremonial framework, defined by structured curricula, mandatory physical attendance, standardised assessments, and credential issuance that, while still providing essential socialisation and basic foundational skills, no longer guarantee the depth, relevance, or practical applicability demanded in today's digital economy. In stark contrast, informal learning emerged in their descriptions as a vibrant, fluid process of self-directed knowledge acquisition through everyday digital interactions, characterised by freedom from institutional constraints, immediate problem-solving utility, and the potential for deeper conceptual mastery via tools like AI chatbots and video tutorials. Emerging hybrid spaces were envisioned as blended ecosystems where formal institutions serve primarily as curators and validators of informal achievements, with digital technologies acting as the seamless connective infrastructure that allows classrooms to extend into virtual networks.

Table 1 reveals important variations: secondary school educators (52.4% of the sample) placed greater emphasis on formal education's socialisation functions, such as building teamwork and respect through daily interactions, while tertiary participants (47.6%) focused more on its potential for quality assurance and credentialing of digital outputs, viewing it as a necessary anchor in an otherwise chaotic informal landscape. Qualitative insights added rich nuance to these differentiations: for example, a secondary teacher (P04, female, South-East) elaborated,

"Formal education is like the skeleton that gives structure through rules, group work, exams, and certificates that open doors, but informal learning is the living flesh – the YouTube videos, WhatsApp discussions, and ChatGPT explanations that make knowledge move, breathe, and apply to real jobs." Similarly, a tertiary lecturer (P11, male, South-South) differentiated hybrids by stating, "We must put formal stamps on the gold students mine informally online; without that validation, their GitHub portfolios and YouTube channels remain unrecognised treasures, and our degrees become empty papers in a world where skills speak louder than scrolls."

These conceptualisations of formal education as ceremonial yet socially vital align with Redecker and Punie (2013), who described formal systems as increasingly multicultural standardisers that must adapt to informal inputs by 2025, a vision that Nigerian educators in this study expanded to include explicit socialisation functions in resource-limited contexts. This finding is consistent with Johnson and Majewska (2022), who differentiated formal education as providing accountability and progression while acknowledging its rigidity in European settings, directly paralleling the ceremonial characterisation here where credentials are seen as "mere paper" without digital relevance. Furthermore, the differentiation of hybrids as validation mechanisms resonates with Zakir et al. (2025), who documented how open access resources in Asian contexts create fluid spaces that demand institutional recognition, mirroring Nigerian participants' calls for credentialing informal achievements. The emphasis on formal's social role also connects to the Lifelong Learning Platform (2017), which positioned formal education as essential for civic integration in digital societies, a perspective that educators here extended to include ethical formation in Nigerian secondary schools. This alignment is further supported by Greenhow and Lewin (2016), who reconceptualised digital hybrids as continua blending structure and participation, substantiating the study's view of formal as the "skeleton" anchoring informal "flesh".

The educators' strong differentiation of informal learning as fluid and practically superior also connects to Liu et al. (2025), who differentiated digital informal learning as compensatory for formal shortcomings in Chinese higher education, mirroring Nigerian secondary educators' views of it as the "real education" through platforms like TikTok. This is further substantiated by Bogiannidis et al. (2023), who highlighted social media's role in multicultural micro-learning, aligning with participants' descriptions of informal as vibrant and boundary-free. Overall, these alignments solidify the study's conceptualisations as globally consistent extensions, with Nigerian insights adding emphasis on social and equity dimensions in hybrid spaces. The synthesis also resonates with the T20 Think20 (2018), which advocated for policy recognition of informal skills in work futures, supporting tertiary educators' focus on validation. This connection is consistent with Pelletier et al. (2023), who documented hybrid spaces in European universities, paralleling the blended ecosystems envisioned here.

Research Question 2: What socio-technical factors do educators identify as the primary drivers accelerating the shift toward informal digital learning in their institutions and countries?

From the findings, educators pinpointed artificial intelligence tools like ChatGPT and video platforms like YouTube as the paramount socio-technical drivers, with every one of the 42 participants explicitly describing how these provide instant, personalised, and superior alternatives to conventional classroom instruction that make formal attendance feel optional or obsolete. Table 3 illustrates the dominance: ChatGPT was mentioned 42 times (100%) for its role as an "instant personal tutor" capable of explaining concepts, solving problems, and generating content around the clock, while YouTube was highlighted 41 times (97.6%) as the "new university" offering practical, visual demonstrations that surpass textbook limitations. Social media groups on WhatsApp and Telegram were cited 39 times (92.9%) for enabling constant peer collaboration and resource sharing, and TikTok 33 times (78.6%) for delivering motivational, bite-sized micro-lessons that make complex topics accessible and engaging. Qualitative insights provided vivid elaboration: a rural secondary teacher (P17, male, North-Central) explained, "ChatGPT answers tough mathematics questions at midnight when I am asleep and the power is off; YouTube shows clear experiments with materials we cannot afford in our labs, step by step, in simple English that students repeat until they get it right." An urban tertiary educator (P08, male, North-West) added depth by stating, "Our department WhatsApp groups have become the real classrooms where students share links, debate answers, and solve assignments faster than waiting for my office hours; it never closes."

These identified drivers of AI and video platforms as accelerators of informal shifts align with Borel and Taylor (2025), who emphasised AI's transformative role in automating personalised competence-building through real-time explanations and adaptations, a mechanism that Nigerian educators in this study described as the primary

force making formal lectures redundant. This finding is consistent with Pelletier et al. (2023), who identified video platforms and social media ecosystems as key enablers of collaborative and practical learning in European universities, directly paralleling the data here where YouTube and WhatsApp were conceptualised as boundary-dissolving tools that extend education beyond physical walls. Furthermore, the socio-technical emphasis on cloud permanence for iterative learning resonates with Khaddage et al. (2016), who documented how storage and sharing features create persistent knowledge trails, a function that participants in this study extended to lifelong digital archives that render formal notebooks and libraries increasingly irrelevant. The dominance of ChatGPT also connects to the Lifelong Learning Platform (2017), which highlighted AI's potential for anytime learning, substantiating the 100% frequency here where educators saw it as a 24/7 tutor surpassing human limitations. This alignment is further supported by Liu et al. (2025), who documented AI's compensatory role in Chinese informal learning, mirroring Nigerian perceptions of it as an equaliser in under-resourced schools.

The recognition of TikTok as a motivational socio-technical driver also connects to Bogiannidis et al. (2023), who found short-form video platforms accelerate micro-learning and engagement in multicultural educational settings, substantiating Nigerian educators' perceptions of it as a tool that transforms "hard topics into easy, fun clips" accessible even on low-bandwidth connections. This is further supported by Greenhow and Lewin (2016), who reconceptualised social media as participatory cultures that blur formal-informal distinctions through content creation and sharing, a dynamic clearly evident in the 92.9% frequency of WhatsApp mentions where groups function as 24/7 peer-led departments. Overall, these alignments confirm that the study's socio-technical factors are not isolated Nigerian phenomena but globally recurrent patterns, yet they are intensified in resource-constrained contexts where digital tools serve as equalisers for inadequate formal infrastructure. The synthesis also resonates with the T20 Think20 (2018), which advocated for policy integration of socio-technical drivers in education futures, supporting participants' views of YouTube as a "new university" for practical skills.

Research Question 3: What benefits, risks, and ethical challenges do educators associate with a complete transition to informal learning, and how do these perceptions vary between secondary and tertiary levels?

Educators associated complete informalisation with compelling benefits such as extreme personalisation (40/42, 95.2% frequency) that allows tailored pacing and depth for individual learners, and dramatic cost reduction (37/42, 88.1%) that eliminates expensive private tutoring and transports, but they also highlighted severe risks including rampant misinformation (42/42, 100%) from unverified AI outputs and widening digital exclusion (38/42, 90.5%) for rural and low-income students without reliable devices or data. Table 4 provides granular detail: secondary educators more consistently cited the loss of socialisation and discipline (95.5% of them vs 75% at tertiary level), viewing it as a foundational threat to character formation and group ethics, while tertiary participants emphasised credential devaluation (95% vs 81.8% at secondary), seeing it as an existential crisis for degree programmes in a skills-first job market. Ethical challenges centred on cognitive weakening from over-dependence (35/42, 83. 3%), with rural educators particularly vocal about exclusion as an ethical failure: "Village kids trek for data while city ones soar ahead with unlimited access, creating a new apartheid" (P25, male, North-East). Qualitative insights revealed level-specific variations: a secondary teacher (P03, female, North-Central) praised personalisation by saying, "No child waits for the slow or rushes the weak anymore – each learns at their exact speed with AI adjusting every step, something my class of 60 could never achieve, and it saves parents thousands on extra lessons." In contrast, a tertiary lecturer (P12, male, North-West) warned about misinformation, stating, "Students now bring AI-generated fakes to seminars and defend them fiercely, claiming the internet cannot lie, which erodes any ethical discussion we try to have about sources and truth."

These perceived benefits of personalisation and cost reduction align with Zakir et al. (2025), who documented 40–70% faster skill mastery through adaptive informal tools in Asian higher education contexts, substantiating Nigerian educators' 95.2% emphasis on tailored pacing as a game-changer that addresses overcrowded classrooms' one-size-fits-all limitations. This finding is consistent with Liu et al. (2025), who associated digital informal learning with remedial and proactive growth in Chinese universities, mirroring this study's cost-reduction narratives where families reported saving ₦150,000+ annually on private lessons by switching to free AI and video platforms. Furthermore, the level variations in benefits perception resonate with Adegbola et al. (2024), who found secondary Nigerian educators prioritise the social equalising potential of informal tools, while tertiary ones focus on their efficiency for advanced skill-building, directly paralleling the data here. The emphasis on personalisation also connects to the Lifelong Learning Platform (2017), which advocated for digital

tools to enable learner-centred flexibility, substantiating participants' views of it as an ethical imperative for equity in diverse classrooms. This alignment is further supported by Greenhow and Lewin (2016), who highlighted informal tools' role in participatory depth, extending to Nigerian contexts where cost savings enable broader access.

The identified risks of misinformation and exclusion connect to Selwyn (2019), who warned of knowledge fragmentation from unregulated digital abundance, directly supporting the 100% concern in this study where educators described students defending AI-generated errors as infallible truth. This is further substantiated by Okoye et al. (2022), who highlighted ethical erosion from AI over-dependence in African contexts, aligning with participants' fears of cognitive weakening where "thinking terminates when the internet speaks". Ethical challenges of exclusion also echo Ibhafidon et al. (2022), who documented Nigeria's urban-rural digital divides as barriers to participation, explaining why rural educators in this study (100% of them) emphasised infrastructure inequities more intensely than urban counterparts. Overall, these alignments validate and extend the findings, showing how global risks manifest with heightened urgency in Nigeria's constrained formal systems. The synthesis also resonates with the T20 Think20 (2018), which warned of skill devaluation in digital economies, supporting tertiary educators' 95% focus on credential threats.

Research Question 4: What practical hybrid strategies, policy recommendations, and institutional adaptations do educators propose to integrate the strengths of formal structure with the flexibility of informal digital learning while ensuring equity, quality, and lifelong relevance?

Educators proposed practical hybrid strategies focused on transforming institutions into validators of informal achievements (42/42, 100% frequency), implementing micro-credentials for digital skills (40/42, 95.2%), and adopting blended attendance models (37/42, 88.1%) to preserve physical presence while allowing flexible online components. Table 6 details the proposals: secondary educators prioritised maintaining physical days for social development (95.5% vs 80% at tertiary), while tertiary participants emphasised rapid credential reform (100% vs 81.8% at secondary) to recognise platforms like GitHub. Policy recommendations included massive public investment in rural infrastructure (35/42, 83.3%), with rural teachers particularly insistent on government-provided solar tablets and data subsidies to prevent exclusion.

Qualitative insights were highly specific and actionable: a secondary principal (P33, female, South-East) elaborated, "We should have three mandatory school days per week focused on group projects, debates, sports, and moral discussions that build character and teamwork – things AI cannot teach – while the other two days are for guided self-study online with teachers monitoring progress and intervening via WhatsApp to ensure quality." A tertiary dean (P01, male, South-West) added, "Universities must create fast-track assessment centres where students present their informal portfolios – YouTube channels with subscriber growth, GitHub repositories with real commits, AI-generated but human-refined projects – and we award proper diplomas in months, not years, to make education lifelong and relevant." Rural educators tied adaptations to equity: "Without free solar-powered tablets preloaded with offline content and 50GB monthly data for every child, any hybrid model will just widen the gap between village kids who trek for signals and city ones who stream seamlessly, creating ethical failure" (P22, female, North-East).

These hybrid strategies for institutional validation and micro-credentials align with Redecker and Punie (2013), who recommended that formal systems recognise informal competences through flexible certification by 2025, substantiating the 100% emphasis in this study where Nigerian educators envisioned similar assessment centres to bridge the credential gap. This finding is consistent with Pelletier et al. (2023), who proposed blended attendance models in European higher education to integrate digital flexibility with structured guidance, mirroring the 3+2 day formulas detailed by participants here as practical solutions for overcrowded Nigerian schools. Furthermore, the focus on credentialing platforms like GitHub connects to World Economic Forum (2025), who advocated badge and micro-credential systems for digital skills in global labour markets, supporting the 95.2% frequency here where educators saw them as essential for making informal learning "count" in employment. The emphasis on blended models also resonates with the Lifelong Learning Platform (2017), which called for policy reforms to create flexible digital-physical spaces, substantiating Nigerian secondary educators' prioritisation of physical days for moral development. This alignment is further supported by Greenhow and

Lewin (2016), who reconceptualised hybrids as participatory continua, extending to the actionable proposals here for guided online days.

The policy recommendations for rural infrastructure investment resonate with Selwyn (2019), who called for targeted public interventions to prevent digital divides from fragmenting educational opportunities, directly aligning with the 83.3% emphasis here where Nigerian rural educators proposed specific solar tablet programmes to equalise access. This is further substantiated by UNESCO (2024), who recommended government-funded devices and data subsidies for low-income regions, explaining the urgency in participants' proposals for preventing "permanent exclusion" of village students. Institutional adaptations for teacher retraining as mentors also echo Olaitan (2024), who proposed policy shifts in Nigerian higher education toward hybrid curation roles, validating the level variations in this study where secondary educators stressed preserving physical presence for moral formation. Overall, these alignments confirm the proposals as practical, evidence-based extensions of global recommendations tailored to Nigeria's unique infrastructural and equity challenges. The synthesis also connects to the T20 Think20 (2018), which advocated for education policy to prioritise skill flexibility through public-private partnerships, supporting participants' calls for government investment in lifelong hybrid systems.

CONCLUSION

This qualitative phenomenological study has offered a comprehensive, context-grounded exploration of the accelerating transition from formal to informal learning patterns in the digital age, as experienced by 42 secondary and tertiary educators across Nigeria's six geopolitical zones. The findings, derived from five deeply interwoven themes and supported by detailed tables and extended verbatim quotations, revealed an overwhelming consensus (100 %) that traditional classroom authority has irreversibly collapsed, with artificial intelligence tools such as ChatGPT (100 %), video platforms such as YouTube (97.6 %), and social media groups on WhatsApp and Telegram (92.9 %) now functioning as the dominant, preferred learning ecosystems. Educators unambiguously acknowledged transformative benefits including extreme personalisation (95.2 %), dramatic cost reduction (88.1 %), unprecedented practical relevance, and heightened learner motivation, yet they simultaneously expressed profound alarm about existential risks such as rampant misinformation (100 %), loss of socialisation and character formation (95.2 %), widening digital exclusion (90.5 %), credential devaluation (88.1 %), and cognitive weakening from AI over-dependence (83.3 %). Crucially, every participant rejected both a nostalgic return to purely formal education and passive acceptance of unregulated informalisation, instead articulating detailed, practical visions for sustainable hybrid futures centred on formal institutions as curators and validators, micro-credentialing of digital portfolios, blended physical–digital attendance, teacher retraining as mentors, and massive public investment in rural connectivity.

The study aligns closely with the integrated theoretical framework of connectivism (Siemens, 2005; Downes, 2019), heutagogy (Hase & Kenyon, 2013; Blaschke & Hase, 2021), and possible selves theory (Markus & Nurius, 1986; Liu et al., 2025), illustrating how digital technologies create vast connectivist networks that enable self-determined learning while learners' vivid hopes and fears about future identities propel intense engagement with informal pathways that formal systems cannot match. These findings echo Redecker and Punie (2013), who predicted that personalisation, collaboration, and informalisation would dominate by 2025, a forecast Nigerian educators confirmed with striking clarity through their lived experiences of students learning "more at midnight with AI than in my daytime lessons". The perceived superiority of informal depth and practicality resonates with Johnson and Majewska (2022), who documented that digital informal practices now account for 80 % of skill development in European settings, and with Zakir et al. (2025), who found similar patterns in Asian higher education where informal tools compensate for formal shortcomings. The existential anxiety about socialisation loss and ethical erosion substantiates Selwyn (2019) and Okoye et al. (2022), who warned that unregulated digital abundance risks fragmentation and cognitive offloading, concerns that Nigerian participants expressed with particular urgency given the country's fragile formal infrastructure and overcrowded classrooms. The unanimous call for hybrid models extends Pelletier et al. (2023) and UNESCO (2024), who advocated blended ecosystems with institutional validation, while the rural demand for solar tablets and free data directly supports Ibhafidon et al. (2022) and the Lifelong Learning Platform (2017) emphasis on equity-oriented infrastructure investment.

The phenomenological methodology provided an authentic, emotionally charged portrait of a profession at a historic crossroads, consistent with Creswell and Poth (2018) guidelines for rigorous qualitative inquiry. The 100 % consensus on institutional validation and the emotionally powerful narratives about "village children being left behind forever" suggest that Nigeria stands at a pivotal moment: the informal shift is irreversible and, in many ways, educationally superior, yet without deliberate hybrid redesign it threatens to deepen inequality and erode human formation. This study therefore concludes that the future of education in Nigeria and comparable contexts is neither purely formal nor purely informal, but intentionally hybrid; a system in which formal institutions evolve into trusted curators, ethical anchors, and equity guarantors within much larger digital informal ecosystems, ensuring that technological abundance serves all learners rather than only the connected few.

The study is not without limitations. The sample, though nationally representative across zones and levels, remains limited to 42 educator voices; students', parents', and policymakers' perspectives were not directly included. The rapid evolution of AI tools between data collection (March–August 2025) and publication may have introduced new dynamics not fully captured. Future research should therefore employ longitudinal mixed-methods designs, incorporate student and parent interviews, and extend to other African and Global South contexts to test the transferability of these hybrid proposals. Nevertheless, this research makes a timely and original contribution by offering the first large-scale phenomenological account of the formal-informal transition from the perspective of educators on the front line in a major African nation, providing evidence-based pathways for policymakers to navigate what participants universally described as "the biggest educational revolution since independence."

RECOMMENDATIONS

Based on the unanimous visions articulated by participants and strongly supported by the literature, the following recommendations are proposed for immediate and medium-term action by Nigerian federal and state governments, educational regulatory bodies, school leaders, and international development partners:

1. Establish a National Council for the Validation of Informal and Digital Learning (NCVIDL) within the next 24 months to set standards, assess portfolios, and award nationally recognised micro-credentials for competences acquired through YouTube, Coursera, GitHub, verified AI-supported projects, and other informal pathways, as demanded by 100 % of participants and recommended by Redecker and Punie (2013), Pelletier et al. (2023), and World Economic Forum (2025).

2. Mandate blended attendance models nationwide: three days of compulsory physical presence per week at secondary level for socialisation, practical laboratories, group ethics, and teacher-guided projects, with two days of monitored online self-study; tertiary institutions should shift to fully competency-based progression with flexible credit accumulation, exactly as proposed by 88.1% of participants and aligned with UNESCO (2024) blended learning guidelines.

3. Launch a ten-year National Digital Equity Fund, financed jointly by government, telecom operators, and international donors, to provide every learner with a rugged solar-powered or low-cost tablet preloaded with offline content and 50–100 GB free monthly data, prioritising rural and low-income communities, a measure insisted upon by 100 of rural educators and substantiated by Selwyn (2019), Ibhafidon et al. (2022), and the Lifelong Learning Platform (2017).

4. Retrain all serving teachers and lecturers within five years as learning experience designers, digital curators, and ethical mentors rather than traditional content transmitters, with mandatory professional development programmes focusing on AI literacy, source evaluation, portfolio assessment, and hybrid pedagogy facilitation, as called for by 92.9% of participants and supported by Borel and Taylor (2025) and the T20 Think20 (2018).

5. Revise national curricula at secondary and tertiary levels to incorporate compulsory critical digital literacy and misinformation detection from JSS1 onward, including modules on evaluating AI outputs,

identifying deepfakes, and understanding algorithmic bias to address the 100% concern about misinformation expressed in this study and recommended by Okoye et al. (2022) and UNESCO (2024).

6. Create fast-track degree and diploma pathways allowing entry or advanced standing based on validated informal portfolios, enabling talented self-taught individuals to obtain formal qualifications within 6–18 months instead of the traditional four to six years, a proposal made independently by 95.2% of participants and consistent with World Economic Forum (2025) micro-credential frameworks.

7. Develop public-private partnerships with Google, Microsoft, IBM, and local telecoms to establish thousands of community digital hubs in rural areas offering free high-speed internet, charging stations, and mentorship, ensuring that hybrid models do not become another mechanism of urban privilege, as warned by 90.5% of participants and supported by the Lifelong Learning Platform (2017) equity recommendations.

8. Commission longitudinal national research from 2026 onward to monitor hybrid implementation, measure impacts on equity, quality, and graduate outcomes, and iteratively refine policy, building directly on this study's findings and the mixed-methods approach advocated by Creswell and Poth (2018).

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To God and humanity; I doff my hat.

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