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Generational Differences in School Leaders' Perspectives on 4IR Adoption in Nigerian Secondary Schools: A Qualitative Study in Kogi State

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Abstract
The Fourth Industrial Revolution (4IR) is reshaping education and work worldwide, placing new demands on school leadership and pedagogical practice. This qualitative exploratory study examined how older (45-60 years) and younger (30-44 years) secondary school leaders in Kogi State, Nigeria, perceive the adoption of 4IR technologies and practices. Guided by Complexity Leadership Theory (CLT), the research focused on three leadership-relevant domains: lifelong learning, knowledge sharing and collaboration, and risk-taking and experimentation. Twelve purposively selected school leaders from four secondary schools participated in semi-structured interviews and observations, the two data sources were triangulated. Data were analysed thematically to identify patterns and variations across and within age groups. Younger leaders more frequently described self-directed digital learning, technology-mediated knowledge exchange and a readiness to experiment with new approaches. Some older leaders expressed greater caution toward technological change and a stronger reliance on established practices. Crucially, these tendencies were not uniform: variation existed within both age cohorts, and differences often aligned with career stage, professional experience, leadership role and access to technological resources rather than chronological age alone. Chronological age is an insufficient explanation for leadership orientations toward 4IR adoption. CLT provided a useful interpretative lens for interpreting administrative, adaptive and enabling leadership functions, but the study cautions

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against a simple mapping of these functions onto age groups. The paper recommends competency-based professional development, structured cross-generational knowledge sharing and strengthened institutional support for technology integration. While findings are context-specific and not statistically generalisable, they offer transferable insights for policy and practice in comparable resource-constrained educational settings.

Keywords: Fourth Industrial Revolution; School leadership; Generational differences; Complexity Leadership Theory; Nigerian secondary education

Introduction

Education remains a cornerstone for achieving sustainable development, particularly in contexts where technological disruption is reshaping labour markets and societal structures. McKinsey (2017) estimated that digitisation, machine learning and automation could displace approximately 3.3 million existing jobs in developing countries while simultaneously creating up to 4.5 million new roles across sectors if technological advancements are proactively embraced. In Nigeria, however, the education sector faces a profound crisis. Peterside (2022) characterises the situation as a "state of emergency," citing nearly 18.5 million out-of-school children, persistent gender inequities in access, and public expenditure on education amounting to only 0.85% of gross domestic product. Under these conditions, waiting for comprehensive policy directives from central authorities is untenable. School leaders must therefore initiate contextually appropriate responses that prepare secondary schools for the demands of 4IR.

The 4IR is characterised by the fusion of physical, digital and biological systems through technologies such as artificial intelligence, robotics, the Internet of Things and advanced automation (Fomunyam, 2019; Schwab, 2016). These developments require educational systems to move beyond traditional content mastery and cultivate 21st-century competencies; critical thinking, collaboration, creativity, communication, digital literacy, and adaptive lifelong learning (Trilling & Fadel, 2009).

Within this landscape, school leaders occupy a pivotal position. Their perceptions, readiness and leadership orientations directly influence whether 4IR imperatives are translated into classroom practice, teacher professional development and school culture. Although studies report age-related differences in educators' use of digital technologies, chronological age alone does not adequately explain technology-related leadership behaviour. Adoption of digital tools is influenced by a mix of individual and organisational factors, such as digital competence, opportunities for professional learning, perceived usefulness, leadership duties, institutional support, access to devices, connectivity and dependable infrastructure (Okunlola & Naicker, 2025; Timotheou et al., 2023). In Nigeria, research on school leaders shows that uptake is shaped not only by attitudes toward digital tools but also by insufficient training, limited funding, weak infrastructure, poor internet access and gaps in institutional backing (Okunlola & Naicker, 2025). Thus, any apparent gap between older and younger leaders may reflect generational position but could equally stem from career stage, professional experience, institutional role, digital competence or unequal access to technological resources. This study addresses a specific empirical shortfall: the scarcity of qualitative research on how school leaders themselves interpret and respond to 4IR adoption, and

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how lifelong learning, knowledge sharing and risk-taking patterns differ both between and within age groups in Nigerian secondary schools.

CLT provides a useful lens for understanding the required leadership responses. CLT distinguishes administrative, adaptive and enabling leadership functions that together support innovation, learning and emergence within bureaucratic organisations such as schools (Uhl-Bien & Arena, 2018; Uhl-Bien et al., 2007). Importantly, generational differences may shape these orientations. Younger leaders, (typically 30-44 years) often display greater familiarity with technology, willingness to experiment and openness to distributed leadership, while older, more experienced leaders, (typically 45-60 years) may prioritise stability, hierarchical control and established routines. Exploring these perceptual differences is therefore essential for designing targeted capacity-building strategies.

Aim and Objective

The overarching aim of this study is to explore the differences in the perceptions of older and younger school leaders regarding the need for the adoption of 4IR technologies and practices in Nigerian secondary schools.

Significance and Justification

The study addresses a critical gap in the literature. While existing research documents present infrastructural barriers, teacher demotivation and low 4IR awareness in Nigerian education (Akinniyi et al., 2020; Oloba, 2023), comparatively little attention has been paid to the differentiated perceptions of school leaders themselves, particularly the contrast between younger leaders and older leaders. Understanding these differences is practically significant: it can inform more nuanced professional development programmes, succession planning, and the strategic deployment of leadership talent across schools. Theoretically, the research extends the application of CLT to an African educational setting by using its administrative, adaptive and enabling functions as interpretive tools for leaders' accounts. Practically, the findings are intended to inform professional development and leadership-support strategies that respond to demonstrated competencies and contextual needs rather than relying solely on age-based categories.

Scope

The study is limited to secondary schools in four local government areas within Kogi State, Nigeria. Twelve school leaders (principals, vice-principals and heads of department) were purposively selected; six classified as older (45-60 years) and six as younger (30-44 years) from schools that had demonstrated relatively strong pre-pandemic performance. Data were generated through semi-structured interviews and observation. While the findings offer transferable insights for similar resource-constrained settings, they are not statistically generalisable to all Nigerian secondary schools. The temporal focus is the post-COVID period, when the urgency of digital readiness became particularly salient.

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Literature Review

Theoretical Framework: Complexity Leadership Theory (CLT)

CLT underpins this study's analytical approach. Initially developed by Uhl-Bien et al. (2007) and refined by Uhl-Bien and Arena (2018), CLT reconceptualises leadership as an emergent, interactive process rather than merely a function of formal authority. The theory distinguishes three interdependent leadership functions: administrative, adaptive and enabling. Administrative leadership involves formal activities that preserve organisational order, including coordination, resource allocation and the maintenance of structures and procedures. Adaptive leadership relates to learning, experimentation and creative problem-solving in response to novel or complex challenges. Enabling leadership focuses on creating conditions that support interaction, knowledge exchange and adaptive action, for example through networks, constructive engagement and access to resources. CLT does not attribute these functions to particular age cohorts; rather, the functions are complementary and may be enacted by the same individual or distributed across multiple actors depending on contextual demands. Interpreting them as inherently tied to generational categories would oversimplify the dynamics of leadership. In this study, CLT functions serve as sensitising concepts for analysing leaders' accounts of lifelong learning, knowledge sharing and risk-taking, while the analysis remains open to overlap among functions and to evidence that falls outside the framework. The study therefore does not treat chronological age as a determinant of any CLT function; rather, it uses the findings to assess whether the patterns observed between and within age groups support, complicate, or extend the application of CLT to 4IR adoption in Nigerian secondary schools.

4IR and Educational Imperatives

The 4IR represents a fundamental shift driven by the fusion of physical, digital and biological systems through artificial intelligence, robotics, the Internet of Things and cyber-physical systems (Fomunyam, 2019; Schwab, 2016). Unlike previous industrial revolutions, its pace and scope demand continuous adaptation. In education, this translates into the need for 21st-century competencies organised around three domains: learning and innovation skills (the 4Cs critical thinking, communication, collaboration and creativity); digital literacies (information, media and ICT literacy); and career and life skills (flexibility, initiative, social intelligence, productivity and leadership) (Trilling & Fadel, 2009). Students must therefore develop not only foundational academic knowledge but also the capacity to learn, unlearn and relearn throughout life. Nigerian secondary education has struggled to respond. Studies indicate that many educators remain reliant on traditional, teacher-centred methods and that awareness of 4IR technologies remains low among practitioners (Akinniyi et al., 2020; Uzochukwu et al., 2019).

School Leadership, Generational Differences and 4IR Readiness

School leaders play a decisive role in mediating these challenges. Their capacity to motivate teachers, model digital practices, create enabling environments and embed 4IR-oriented learning cultures is critical (Afandi et al., 2021). Yet leadership orientations are not uniform, and reported differences in technology engagement should not be understood solely through chronological age. A growing body of evidence highlights generational differences between younger leaders and older, more experienced leaders. Younger educators and leaders tend to display higher technological self-efficacy, greater willingness to experiment, and more frequent engagement with

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informal knowledge-sharing networks (Eynon & Malmberg, 2011; Stevenson et al., 2016). Older leaders, while often richer in institutional knowledge and administrative expertise, may exhibit greater caution, lower adaptive complexity and a preference for established routines (Orlando, 2014). Although some studies report age-associated differences in technology engagement, these patterns should not be interpreted as evidence that adaptive, enabling or administrative leadership functions belong to particular age groups. The existing literature provides useful indications of possible differences in technology engagement, but it also points to the importance of experience, professional learning, institutional conditions and access to resources. The present study therefore examines whether age-associated patterns are evident while remaining attentive to variation within age groups.

Gaps in the Literature

Existing studies have documented infrastructural shortfalls, teacher-related challenges and limited awareness of 4IR technologies in Nigerian education (Oke & Fernandes, 2020; Oloba, 2023). However, comparatively little research has focused on how school leaders themselves understand the need for 4IR adoption and how they describe their willingness to learn, share knowledge and respond to uncertainty. It remains unclear whether reported differences between older and younger leaders primarily reflect chronological age or whether they are better explained by factors such as digital competence, professional experience, career stage, institutional responsibilities and access to technological resources. This study addresses these gaps by exploring how older and younger school leaders in selected Nigerian secondary schools perceive 4IR adoption. Generation is employed as an analytical lens rather than a definitive explanation of leadership behaviour.

Methodology

Research Design and Participants

This study employed a qualitative exploratory design within an interpretivist paradigm to investigate differences in school leaders' perceptions of 4IR adoption. Research was conducted in four secondary schools across four Local Government Areas of Kogi State, Nigeria. Schools were purposively selected on the basis of relatively strong academic performance prior to the COVID-19 pandemic to provide a comparable context for examining leadership perspectives on technological change. Twelve school leaders participated: a principal, a vice-principal and a head of department from each school. Participants were grouped for analytical comparison into older leaders (45-60 years) and younger leaders (30-44 years), with six participants in each group. Age categories were used as an analytical lens rather than as fixed generational identities. The decision to include six participants from each age group was analytically driven. In this exploratory qualitative comparison, equal representation supported the identification of patterns, contradictions and within-group variation without implying statistical representativeness. The sample of twelve participants was intended to prioritise depth and richness of data rather than breadth

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Data Collection

Data were collected using two complementary instruments: a semi-structured interview guide and an observation schedule. Interviews that lasted approximately 90-120 minutes, were audio-recorded with consent and transcribed verbatim. Interview topics addressed lifelong learning, knowledge sharing and collaboration, and willingness to take risks in relation to 4IR adoption. Observations were conducted alongside interviews and targeted leadership activities, ICT-related meetings, technology use, staff interactions and the broader school environment. Informal observations and reflections were recorded in a research journal. The combination of interviews and observations enabled triangulation between participants' reported perceptions and observable practices.

Data Analysis

Transcripts and observation notes were analysed thematically following Braun and Clarke. The researcher engaged in repeated reading of the data, generated initial themes, clustered related sub-themes into categories and developed themes inductively from participants' accounts and observations. CLT was subsequently applied as a sensitising framework to interpret findings through its administrative, adaptive and enabling functions rather than as predetermined coding categories. The analysis examined similarities and differences within and between the two age groups and attended to data that contradicted emerging patterns. Three principal themes were identified: lifelong learning**,** knowledge sharing and collaboration, and risk-taking.

Trustworthiness

Trustworthiness was addressed through strategies targeting credibility, dependability, confirmability and transferability. Credibility was enhanced by prolonged engagement with transcripts and observation notes, member checking and triangulation of interview and observation data. Dependability was supported by maintaining an audit trail documenting research procedures, transcripts, field notes and thematic decisions. Confirmability was strengthened through supervisory debriefing and by grounding interpretations in direct participant quotations and observation extracts. Transferability was facilitated by providing detailed descriptions of the study setting, participant characteristics and research procedures so that readers can assess the applicability of findings to comparable contexts. Triangulation was undertaken by comparing participants' interview accounts with the observation data. Interviews provided information about how school leaders perceived lifelong learning, knowledge sharing, collaboration and risk-taking, while observations provided contextual evidence of leadership practices, technology use, staff interactions and ICT-related activities.

Results

Thematic analysis of the interview transcripts and observation notes generated three overarching themes that capture differences in the perceptions of older and younger school leaders regarding the need for 4IR adoption in Nigerian secondary schools: (1) Lifelong learning, (2) Each one teach one, and (3) Risk-taking. Each theme contains related sub-themes. While some age-related tendencies were observable, important variation existed within both groups. These within-group differences are highlighted throughout the presentation of findings. Findings are presented below with illustrative verbatim quotations. Participants are identified by number and age category (older = 45-60 years; younger = 30-44 years), Illustrative quotations are presented to exemplify the main

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patterns and the notable variations within each age group. Not every participant is quoted on every theme; some responses were repetitive and are therefore not reproduced in full.

Theme 1: Lifelong Learning

Motivation and interest

Most younger leaders consistently expressed strong personal interest in technology and 4IR-related developments. One stated: *"I am so much interested in improving my technological skills…" (Participant 2, younger)*. Another noted: *"I have decided to [get] a modem for data connection with my sim card for my personal use because I'm highly having interest in latest technology" (Participant 9, younger).* In contrast, several older leaders indicated limited interest, often linking this to proximity to retirement or perceived governmental neglect: *"…as for me, I'm not interested and I can never be interested before I apply for my retirement…" (Participant 4, older). "…my dear, where is the strength for me to start moving from one place to another… I only have less than three years to leave the service…" (Participant 10, older).*

Use of personal digital devices

Observation and interview data showed that all 12 leaders possessed Android phones. However, only four leaders (all younger) regularly used personal laptops for professional tasks such as record-keeping and information processing. One observation note recorded: *"On the vice principal's (young school leader) table, I observed… a personal laptop computer where he records the names of every cleared student and saved immediately into Google drive; two android phones…" (Observation notes, 28 September 2022).* This observation provides contextual evidence of technology use in administrative work, but it does not by itself establish that age was the reason for the observed difference in device use. Younger leaders frequently advocated for wider provision of devices: *"I'm suggesting that the government should… provide such device… Even if the government cannot give them free of charge, they can give them at a subsidized rate" (Participant 8, younger).*

Modes of self-directed learning

Four younger leaders reported independently seeking information about 4IR and related technologies: *"Yes, I have heard it before… I later personally search for it on Opera Mini internet browser to learn about it" (Participant 5, younger). "I personally devout time to learn about latest technologies, at times I learn some via YouTube… I have my personal laptop and I do subscribe for data…" (Participant 12, younger).* No older leader described comparable self-initiated online learning.

However, the responses of older participants were not uniform. Participants 1 and 6 expressed interest and eagerness towards 4IR-related learning, while Participant 7 expressed interest and eagerness but was not considered ready. These cases indicate variation within the older group and suggest that interest, eagerness and readiness did not correspond consistently with age category.

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Theme 2: Each One Teach One

Sharing knowledge

Both groups reported informal knowledge exchange, yet younger leaders more frequently initiated discussions about technology. One younger leader explained: *"I initially heard of it through a WhatsApp message from my colleagues, then I started to talk about it amongst those in my department. We were all interested in how they were using technology in their classrooms" (Participant 3, younger).* Observation notes confirmed routine sharing of information among staff during breaks and briefings.

Informal networking and collaboration

Younger leaders described using online platforms and informal networks to access ideas beyond their immediate schools: *"As we can go online and be a part of the seminars that are offered globally for free, it has become better to connect with ideas from elsewhere… Others in Africa are in the same boat as us. We can help each other" (Participant 3, younger).* Weekly management meetings provided formal spaces for collaboration, with younger leaders more often proposing digital alternatives: *"…we have tried to use the online platforms to consult with teachers. They have been discussing how much easier it is for them to ask questions… So, I think you can try this online mode…" (Participant 5, younger).*

Theme 3: Risk-Taking

Willingness to experiment and innovate

Younger leaders expressed readiness to try new approaches despite uncertainty: *"Actually, in this life, everything is a risk… one needs to always take up a risk in other to face reality of life" (Participant 8, younger). "You have to try new ways, and there is so much we can learn. You have to look past what we don't have to what we can do with what we have" (Participant 5, younger).* Older leaders were more cautious. One stated: *"…I can no longer face any challenge as of the time of my youth… I'm now getting old and the mind and zeal is no longer as strong as it was before" (Participant 4, older).* Nevertheless, the pattern was not uniform among older participants. Participant 10 provides a contrasting case: although the participant expressed limited interest and eagerness towards 4IR-related activities, the participant was nevertheless classified as ready to take risks. This apparent contradiction indicates that interest, eagerness and willingness to take risks did not necessarily occur together and further demonstrates variation within the older group.

Vulnerability and failing forward

Younger leaders openly accepted the possibility of failure as part of learning: *"We have to experiment but experiments sometimes work and sometimes they don't work. I have to be open to failure, that's part of learning too" (Participant 3, younger).* They also reported encouraging colleagues to adopt student-centred methods: *"We try to encourage colleagues to change how they teach. They must facilitate learning where collaboration and critical thinking are a key focus" (Participant 8, younger).*

Overall, the findings suggest some differences between the age groups in relation to lifelong learning, knowledge sharing and risk-taking, particularly in accounts of self-directed digital learning and experimentation. However, the findings also reveal substantial variation within the age groups. Positive orientations towards 4IR-related learning were evident among some older

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participants, while the case of Participant 10 demonstrates that limited interest did not necessarily correspond with unwillingness to take risks. The findings therefore suggest patterns of difference between the groups without indicating that age alone determines school leaders' orientations towards 4IR adoption.

Discussion

The findings of this study indicate some differences in the perceptions and practices of older and younger school leaders regarding 4IR adoption in Nigerian secondary schools, particularly in relation to lifelong learning, knowledge sharing and risk-taking. However, these differences were not uniform, as variation was also evident within both age groups. Interpreted through CLT, the findings provide evidence of adaptive and enabling leadership behaviours among several participants, while also showing that these behaviours cannot be neatly assigned to particular age groups.

Lifelong Learning and Adaptive Capacity

Several younger leaders demonstrated higher motivation, more frequent use of personal digital devices, and active engagement in self-directed learning. This pattern aligns with research indicating that younger leaders display greater technological self-efficacy and are more inclined to pursue continuous upskilling (Eynon & Malmberg, 2011; Stevenson et al., 2016). In contrast, several older leaders expressed limited interest, often linking their stance to proximity to retirement or frustration with systemic neglect echoing documented challenges of teacher demotivation and low 4IR awareness in the Nigerian context (Akinniyi et al., 2020; Oloba, 2023).

From a CLT perspective, the self-directed learning behaviours of younger leaders exemplify adaptive leadership: the capacity to generate new knowledge, respond to environmental change, and maintain personal learning agility within complex systems (Uhl-Bien & Arena, 2018). Their willingness to seek information independently and experiment with available tools also reflects the creation of "adaptive space," a core enabling condition in the meso-model of CLT (Uhl-Bien et al., 2007). Older leaders' more cautious stance, while understandable given career stage and accumulated administrative responsibilities, risks constraining the organisation's overall adaptive capacity at a time when 4IR demands continuous learning (Fomunyam, 2019; Trilling & Fadel, 2009).

Knowledge Sharing, Networking and Enabling Leadership

Both age groups reported knowledge sharing and collaboration, while several younger participants described initiating discussions about technology and using informal networks to access new ideas. These practices resonate with the literature on distributed and collaborative leadership in digitally evolving educational environments (Afandi et al., 2021). However, the present study extends this discussion by showing that informal knowledge sharing was not exclusive to younger leaders; rather, the age groups differed mainly in the ways participants described using technology to support such exchanges. The "each one teach one" ethos observed among younger participants further supports the view that peer-to-peer learning can partially compensate for formal professional development deficits in resource-constrained settings.

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Within CLT, the reported practices of connecting colleagues, circulating ideas and accessing external knowledge can be interpreted as enabling leadership because they create conditions for interaction and knowledge exchange (Uhl-Bien et al., 2007). However, the findings do not support the conclusion that enabling leadership is a characteristic of younger leaders alone. The important distinction is therefore between the leadership behaviour observed or reported and the age category of the participant. This interpretation is consistent with CLT's view of leadership functions as interdependent and context-dependent rather than fixed characteristics of particular individuals or groups.

Risk-Taking, Experimentation and Emergence

Perhaps the most distinctive finding concerns risk-taking. Younger leaders expressed greater readiness to experiment, innovate, and treat failure as a learning opportunity. This disposition is consistent with research showing that younger leaders are more comfortable with technological uncertainty and iterative practice (Orlando, 2014). Older leaders, by contrast, frequently cited declining energy, risk aversion, or the perceived futility of change near the end of their careers. The greater willingness to experiment reported by several younger participants is broadly consistent with research associating younger educators with greater comfort with technological change and iterative practice (Orlando, 2014). However, the risk-taking response of Participant 10 diverges from a simple age-based interpretation. The finding therefore suggests that willingness to experiment may be influenced by factors beyond chronological age, including individual disposition, professional experience, perceived consequences of change and the particular organisational context.

CLT provides a useful lens for interpreting the participants' willingness to experiment as adaptive behaviour because adaptive leadership involves responding to emerging challenges, learning through experimentation and generating new possibilities (Uhl-Bien & Arena, 2018). Nevertheless, the evidence from Participant 10 complicates the assumption that such adaptive behaviour is more closely associated with younger leaders. The findings indicate that adaptive and risk-taking behaviours may occur alongside apparently cautious or limited orientations towards 4IR, suggesting that leadership functions may coexist within the same individual rather than being neatly distributed between age groups.

Integrating the Findings within CLT and the Nigerian Context

Collectively, the three themes indicate that participants differed in their orientations towards lifelong learning, knowledge sharing and risk-taking, with some patterns appearing more frequently among younger participants. However, the findings also reveal important within-group variation. Participant 10 demonstrated willingness to take risks despite expressing limited interest and eagerness. These case indicate that the observed patterns cannot be adequately explained by chronological age alone.

These patterns reinforce calls in the literature for more intentional leadership development and succession strategies that deliberately cultivate adaptive and enabling behaviours among all school leaders, regardless of age (Uhl-Bien & Arena, 2018). They also underscore the practical importance of pairing digitally fluent younger leaders with experienced older colleagues in mentoring arrangements that can accelerate collective capacity. In resource-scarce environments

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such as many Nigerian secondary schools, leveraging the complementary strengths of both groups offers a more realistic pathway toward 4IR-aligned practice than waiting for large-scale infrastructural or policy transformation.

CLT offers a valuable interpretive framework for these findings because the three emergent themes; learning, experimentation and interaction map onto behaviours associated with adaptive and enabling leadership. The data therefore align with CLT's emphasis on learning, experimentation and knowledge exchange. However, CLT does not account for these behaviours in terms of chronological age, nor does it imply that administrative, adaptive and enabling functions are the exclusive domain of distinct demographic groups.

The substantial within-group variation observed in this study highlights the limits of applying CLT through a simple generational lens. Participants within the same age category displayed different leadership orientations, and individual accounts often reflected more than one CLT function simultaneously. Thus, while the findings endorse CLT's usefulness as an analytic tool, they also complicate its application to generational differences in 4IR adoption. In particular, the evidence suggests that adaptive and enabling behaviours are better understood as emergent, context-dependent practices that arise from interactions among individuals, organisational conditions, experience, resources and shifting technological demands, rather than as traits inherently associated with younger leaders.

The study's contribution lies in moving beyond a simplistic younger-versus-older framing of 4IR leadership in Nigerian secondary schools. While the findings identify some age-associated tendencies, such as greater self-directed digital learning, technology-mediated knowledge sharing and a higher propensity to experiment among younger leaders they also reveal substantial heterogeneity within both cohorts. Consequently, the research demonstrates that chronological age may correlate with certain patterns of response but is insufficient as a standalone explanation for school leaders' orientations toward 4IR adoption; a fuller account must consider interacting factors such as career stage, professional experience, positional responsibilities, digital competence and access to resources.

Recommendations

Based on the study's findings, the following recommendations are proposed:

1. Adopt competency-based leadership development Design professional development programmes around demonstrated digital competencies and individual learning needs rather than chronological age.
2. Promote cross-generational knowledge exchange Encourage collaboration and mentoring among leaders so that digital, pedagogical and organisational expertise can be shared across age groups.
3. Create safe opportunities for experimentation Support school leaders to pilot small-scale technology initiatives and to learn from both successes and failures in low-risk settings.
4. Strengthen digital access and infrastructure Prioritise improvements in reliable electricity, device availability and internet connectivity to enable sustainable 4IR adoption.

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5. Provide sustained, practice-based professional learning Move beyond one-off workshops toward ongoing, practice-oriented training, peer support and reflective learning opportunities.

Conclusion

This qualitative study examined how secondary school leaders in selected schools in Kogi State perceive the adoption of 4IR technologies and practices. Younger participants more frequently reported self-directed digital learning, technology-mediated knowledge sharing and a willingness to experiment, while some older participants emphasised caution and reliance on established procedures. Crucially, substantial variation within both groups indicates that these patterns should not be interpreted as determined by age alone. CLT offered a useful lens for interpreting administrative, adaptive and enabling leadership functions, but the findings demonstrate that these functions cannot be straightforwardly assigned to particular age cohorts. Instead, leadership responses to 4IR are shaped by multiple interacting factors, including career stage, professional experience, leadership role and access to technology. Accordingly, the study recommends a competency-based approach to leadership development rather than age-based assumptions. Given the small, purposive sample drawn from four schools in a single Nigerian state, the findings are not statistically generalisable; however, they offer cautiously transferable insights for comparable educational contexts seeking to strengthen leadership capacity for equitable and context-sensitive 4IR adoption.

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