Sociological Perspective on Transformative Curriculum Design and Implementation in The Nigerian Education System in The Fourth Industrial Revolution (4IR)

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ABSTRACT: This study examines the alignment of the Nigerian education system with the demands of the Fourth Industrial Revolution (4IR), with a focus on curriculum design. The research adopted a quantitative survey design, with a population of 300 respondents drawn from universities in Lagos State. The study used a structured questionnaire for data collection, and the reliability and validity of the instrument were ensured through pre-testing and expert review, yielding a Cronbach's alpha coefficient of 0.85. Descriptive statistics, including frequency counts, percentages, and means, as well as inferential statistics such as Chi-square tests and correlation analysis, were employed to analyse the data. The findings indicate that there is a statistically significant relationship between respondents' views on curriculum alignment and its relevance to 4IR needs (p=0.033), with a moderate positive correlation of 0.65. Faculty preparedness for teaching technology-related content shows a strong positive correlation (r =0.72, p=0.000), highlighting the importance of continuous professional development. Infrastructure availability is significantly related to digital learning success (p=0.036), with a negative correlation (-0.58) suggesting that infrastructure limitations impede effective digital learning. Social equity in the curriculum shows no significant relationship (p=0.14), but a moderate positive correlation (r=0.48, p=0.043) points to potential improvements. In conclusion, this study underscores the importance of transformative curriculum design and its alignment with the Fourth Industrial Revolution (4IR) in shaping the future of Nigerian education. The study recommended that the Nigerian education system should prioritize integrating 4IR competencies, including digital literacy, problem-solving, and critical thinking, across all levels of the curriculum, among others.

KEYWORDS: Sociological perspective, transformative, curriculum design, implementation, curriculum, fourth industrial revolution (4ir).

INTRODUCTION

The Nigerian education system, like many others, is undergoing significant transformations due to technological advancements associated with the Fourth Industrial Revolution. The 4IR encompasses artificial intelligence, machine learning, automation, biotechnology, and the Internet of Things, reshaping industries and societal structures. These changes necessitate an urgent redesign of curricula to meet the needs of a future workforce that demands new skills, knowledge, and competencies. Sociologically, curriculum development is a reflection of society's values, priorities, and economic needs. In Nigeria, the education system must evolve to bridge the gap between current educational practices and the demands of the Fourth Industrial Revolution.

The Fourth Industrial Revolution (4IR), driven by rapid advancements in artificial intelligence, robotics, and big data, has reshaped global educational paradigms. These necessitating curriculum designs align with 21st-century goals of innovation, critical thinking, and adaptability. Education in the 4IR goes beyond traditional pedagogies, demanding an emphasis on digital literacy, interdisciplinary knowledge, and life-long learning (Schwab, 2016). In this context, Nigeria, like many developing nations, faces the dual challenge of leveraging sociological insights to bridge socio-economic disparities while embracing global trends in transformative education.

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Sociology offers valuable perspectives for understanding and addressing the complexities of curriculum transformation. Functionalist theorists, such as Durkheim (1956), highlight education's role in societal cohesion and skill transmission necessary for industrial growth. However, conflict theorists, including Bourdieu (1986), argue that unequal access to educational resources perpetuates social inequalities, a pressing issue in Nigeria, where urban-rural divides and infrastructural deficits constrain equitable curriculum implementation (Adedeji, 2020).

In Nigeria, the introduction of the Universal Basic Education (UBE) programme and recent reforms incorporating technical and vocational education and training (TVET) demonstrate efforts to align with 4IR demands. Yet, implementation challenges persist, with inadequate teacher preparation and a lack of technological infrastructure posing significant barriers (Nwagwu, 2022). Moreover, Nigeria's education system must navigate the tension between global educational competitiveness and the preservation of culturally relevant learning. Scholars such as Ekwueme (2021) argue for integrating indigenous knowledge systems into 4IR-aligned curricula to ensure inclusivity and local relevance.

Globally, transformative curricula prioritise student-centred learning, interdisciplinary approaches, and competency-based assessment, as evidenced by initiatives in countries like Finland and Singapore (Menon & Castrillon, 2019). Drawing lessons from such models while addressing Nigeria's unique socio-cultural and economic contexts underscores the importance of sociological inquiry in shaping sustainable educational reform. This study applies sociological lenses to transformative curriculum design, Nigerian education can bridge gaps in equity and access, equipping learners with the skills required for meaningful participation in the 4IR-driven global economy. This paper uses a sociological lens to explore how transformative curriculum design and implementation can address societal needs in the context of 4IR and Nigeria's educational challenges while positioning the system for global relevance in the 4IR.

The problem
The Nigerian education system faces challenges in preparing students for the Fourth Industrial Revolution (4IR), with traditional curricula lacking in digital literacy, critical thinking, and interdisciplinary learning. Despite educational reforms like the Universal Basic Education programme, implementation challenges persist, including infrastructure issues, inadequate teacher training, limited access to digital tools, and disparities between urban and rural schools. Socio-cultural factors and the undervaluation of indigenous knowledge also hinder the development of globally relevant curricula. A comprehensive, sociologically informed approach to curriculum reform is needed to address these challenges and bridge the gap between urban and rural schools.

Purpose of the study
   i. To examine how sociological theories, particularly functionalist and conflict perspectives, can be applied to the design and implementation of transformative curricula in the Nigerian education system to meet the demands of the Fourth Industrial Revolution (4IR).
   ii. To investigate the challenges and opportunities in implementing a transformative curriculum in Nigeria, focusing on addressing issues of equity, cultural relevance, and technological integration.

Questions
   i. How do sociological perspectives influence the design and implementation of transformative curricula in the Nigerian education system?
   ii. What are the key challenges and opportunities in implementing transformative curricula aligned with the demands of the Fourth Industrial Revolution in Nigeria?

Hypotheses
HO_1:   There is no significant relationship between sociological perspectives and the design and implementation of transformative curricula in the Nigerian education system.
HO_2:   There is no significant effect of transformative curriculum implementation on addressing the challenges of equity, cultural relevance, and technological integration in the Nigerian education system.

THEORETICAL FRAMEWORK
This study draws upon *Functionalism* and *Conflict theory* to analyse the sociological underpinnings of transformative curriculum design and implementation in the Nigerian education system, particularly in the context of the Fourth Industrial Revolution (4IR).

Functionalism, as articulated by Émile Durkheim in 1956, views education as a crucial institution that contributes to societal stability and cohesion. According to Durkheim, education serves as a mechanism for transmitting shared values and norms, thereby

promoting social integration. The education system is seen as a means of preparing individuals for their roles in society, equipping them with the necessary skills for economic participation, and ensuring the continuation of societal order (Durkheim, 1956).

In the context of this study, the relevance of functionalist theory lies in its focus on education's role in preparing students for the technological and industrial demands of the 4IR. A well-designed curriculum that aligns with the functionalist perspective would provide students with skills in critical thinking, problem-solving, and digital literacy, which are essential for their integration into a rapidly evolving workforce. As such, this theory offers a lens through which we can understand the importance of a transformative curriculum that meets both societal needs and global economic demands.

Conflict theory, primarily developed by Karl Marx (1867) and later expanded by Pierre Bourdieu (1986), posits that education is a tool of social stratification, reinforcing inequalities based on class, ethnicity, and other social factors. Marx argued that education perpetuates the interests of the dominant class by transmitting their cultural values and social capital, thus ensuring the reproduction of existing power structures. Similarly, Bourdieu's theory of cultural capital suggests that students from privileged backgrounds are better equipped to succeed in the education system because they possess the cultural and social assets valued by the school system. In the Nigerian context, where significant educational disparities exist between urban and rural areas, conflict theory is particularly relevant. The implementation of a transformative curriculum that integrates technology addresses socio-cultural biases, and promotes equitable access to resources is essential in counteracting the reproducing effect of educational inequality. Conflict theorists would argue that curriculum reform must challenge the systemic structures that perpetuate privilege and marginalisation in the educational system, ensuring that all students, regardless of background, have an equal opportunity to succeed in the 4IR economy.

In addition to functionalism and conflict theory, theories that emphasise the importance of cultural relevance in education offer critical insights for curriculum transformation in Nigeria. Scholars such as Ekwueme (2021) argue that curricula should not merely mirror global standards but should also reflect the local socio-cultural contexts of students. This study explores the transformative curriculum in Nigeria, aiming to promote social cohesion, reduce inequality, and prepare students for the Fourth Industrial Revolution. It uses functionalist theory, conflict theory, and cultural relevance to ensure all students benefit.

LITERATURE REVIEW
Conceptual clarification
In examining the sociological perspective on transformative curriculum design and implementation within the Nigerian education system in the context of the Fourth Industrial Revolution (4IR), it is necessary to clarify some key concepts that form the foundation of this study. These concepts provide insight into the processes, challenges, and potential outcomes of educational reforms in Nigeria, particularly concerning societal needs, technological advancements, and social equity, among others.

Transformative curriculum design
Transformative curriculum design refers to the process of reshaping the content, structure, and delivery of educational programmes to meet the needs of the modern, digital, and interconnected world. In the context of the 4IR, this involves integrating technology, critical thinking, and interdisciplinary learning into the curriculum. The aim is not only to impart knowledge but also to equip students with the skills necessary to navigate complex societal challenges and technological advancements (Kozma, 2011; Ekwueme, 2021). This transformation is essential for enabling students to adapt to rapidly changing industries and global work environments (Schwab, 2016). In Nigeria, curriculum reform has been a subject of discourse for several decades. However, many schools continue to rely on traditional, rote-learning methods that are ill-suited to the demands of the 4IR. The need for transformative curriculum design in Nigeria is particularly pressing given the rapid pace of technological innovation and the gap in digital literacy (Nwagwu, 2022).

Fourth Industrial Revolution (4IR)
The Fourth Industrial Revolution, as defined by Klaus Schwab (2016), is characterised by a range of technological advancements, including artificial intelligence, robotics, the Internet of Things (IoT), and biotechnology, which are changing industries, societies, and everyday life. In education, the 4IR demands curricula that promote digital literacy, creativity, and critical problem-solving skills. The 4IR requires that students not only learn how to use technology but also understand how to innovate, collaborate, and adapt in a world that is increasingly dependent on interconnected, intelligent systems (Schwab, 2016).

For Nigeria, the challenge lies in integrating these technological advancements into an education system that has historically been under-resourced and plagued by inequality (Adedeji, 2020). The concept of the 4IR presents both an opportunity and a challenge for transforming education systems to equip students for a new global economy.

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Sociological perspective on education

The sociological perspective on education examines how education systems influence and are influenced by societal structures, cultural norms, and power dynamics. Functionalist theorists, such as Émile Durkheim (1956), argue that education is crucial in promoting social cohesion and preparing individuals for societal roles. Conflict theorists, such as Pierre Bourdieu (1986), view education as a tool for reproducing social inequalities by perpetuating the interests of the dominant classes. Understanding these perspectives is key to analysing how curriculum reforms might either reinforce or challenge existing societal inequities in Nigeria. In the context of the 4IR, sociological theories emphasize the need for education systems to be responsive to technological change and the social inequalities that may hinder equitable access to these changes. Reforms must, therefore, address both the content of the curriculum and the structures that determine access to education, including resource allocation, teacher training, and technological infrastructure (Bourdieu, 1986; Nwagwu, 2022).

Cultural relevance in education

Cultural relevance in education refers to the integration of local knowledge, languages, and cultural practices into the curriculum. In the Nigerian context, this is particularly important because the education system has often been criticized for its Eurocentric approach, which overlooks indigenous knowledge and cultural values. Scholars like Ekwueme (2021), and Ojo and Salisu (2020) argue that incorporating local culture and indigenous knowledge into curriculum design can enhance students' engagement, ensure that learning is relevant to their lived experiences, and create a more inclusive educational environment.

The importance of cultural relevance becomes more pronounced when considering the diverse cultural terrain across Nigeria. A curriculum that does not resonate with students' cultural backgrounds risks alienating them and contributing to higher dropout rates, especially in rural areas where students are less likely to connect with a curriculum that feels foreign (Ekwueme, 2021).

Social equity in education

Social equity in education refers to providing equal educational opportunities to all students, regardless of their socio-economic background, gender, ethnicity, or geographical location. In Nigeria, educational disparities are profound, particularly between urban and rural areas, as well as between rich and poor students (Adedeji, 2020). The lack of access to quality education, modern learning tools, and trained teachers exacerbates these inequalities and limits students' ability to succeed in the 4IR.

For curriculum reforms to be truly transformative, they must not only focus on technological integration but also ensure that all students have access to the tools and skills needed to succeed in an increasingly digital world. This requires addressing systemic barriers to education, such as inadequate infrastructure and teacher professional development, and implementing policies that promote equal access and opportunities for all students (Nwagwu, 2022; Adedeji, 2020).

Transformative curriculum design and implementation in the context of societal needs in the Fourth Industrial Revolution (4IR)

The Fourth Industrial Revolution (4IR) is ushering in an era of rapid technological advancements, including artificial intelligence, robotics, the Internet of Things (IoT), and advanced data analytics. These changes are profoundly influencing global economies and societies, and they demand a shift in how education systems prepare students for the future workforce. One of the most pressing challenges is aligning curriculum design and implementation with the dynamic societal needs brought about by the 4IR.

Curriculum Design for Societal Relevance in the 4IR

Transformative curriculum design refers to the process of rethinking and redesigning educational curricula to better align with the changing needs of society, particularly in light of technological advancements. This approach aims to equip students not only with foundational knowledge but also with the critical skills required for future industries, such as digital literacy, problem-solving, and adaptability (Schwab, 2016). In the context of the 4IR, this transformation involves integrating advanced technological concepts into traditional curricula, while also emphasizing social, emotional, and ethical competencies necessary for navigating the complex, interconnected world (Ekwueme, 2021).

To meet the societal needs of the 4IR, curricula must be flexible, adaptable, and forward-thinking. According to Wang and Xie (2021), educational institutions must prioritize competencies such as creativity, innovation, and digital fluency, which are essential for participating in the fast-evolving global economy. Curriculum redesign should also ensure that students are exposed to emerging fields such as data science, robotics, and AI, in addition to traditional subjects like science, mathematics, and humanities. This approach ensures that education serves as a tool for societal growth, helping to address the demands of a rapidly changing job market (OECD, 2020).

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Linking Curriculum Design to Societal Needs

Effective curriculum design in the 4IR context requires an understanding of how societal needs are shaped by technological progress. These needs span across various sectors, including health, agriculture, finance, and education. For example, the healthcare sector is increasingly relying on artificial intelligence for diagnostic purposes and personalized medicine, meaning that students entering this field need to be trained not just in healthcare concepts but also in computational tools and AI ethics (Brynjolfsson & McAfee, 2014). Similarly, as the global economy moves towards digital finance and blockchain technologies, the education system must prepare students for these sectors by including modules on financial technology, cyber security, and data protection (Ojo & Salisu, 2020).

The societal implications of the 4IR are broad and transformative curriculum design should account for this by ensuring inclusivity and equity. For example, the integration of technology into the curriculum must be done in a way that reduces the digital divide between urban and rural areas and between socio-economic groups. The aim should be to provide all students with equal access to the tools and knowledge necessary to thrive in the 4IR landscape. Nwagwu (2022) argues that for transformative curriculum design to be successful in Nigeria, it must address both technological readiness and social inequalities, ensuring that the benefits of educational reforms are equally distributed.

Implementation of Transformative Curriculum

Implementing a transformative curriculum involves several key steps: policy reform, teacher professional development, resource allocation, and infrastructural support. First, policymakers must prioritize curriculum reforms that align with 4IR needs, ensuring that education policies are agile enough to keep pace with technological change. This requires strong collaboration between governments, educational institutions, and industries (Bertoni et al., 2020). Additionally, teachers must be supported with the necessary training and resources to effectively deliver new content, particularly in digital and technological subjects. This aligns with the view that teacher competence is crucial for the successful integration of technology into classrooms (Hennessy et al., 2015). Further, infrastructural challenges such as limited access to technology and inadequate school facilities must be addressed to ensure that the transformative curriculum is accessible to all students, particularly in underdeveloped regions. The need for equitable access to learning resources is emphasized by Ekwueme (2021), who highlights that without the necessary infrastructure, students in marginalized communities are at risk of being excluded from the benefits of the 4IR.

Challenges to Curriculum Transformation

Despite the potential benefits, several challenges impede the successful implementation of transformative curriculum design in Nigeria's education system. These include insufficient funding, lack of trained personnel, outdated infrastructure, and resistance to change from traditional educational structures (Ojo & Salisu, 2020). Additionally, there is the challenge of aligning the skills taught in schools with the rapidly changing demands of the labour market. As technological advancements often outpace curriculum revisions, educators face the difficult task of preparing students for jobs that may not yet exist or for industries that are still in the early stages of development (Brynjolfsson & McAfee, 2014).

Nigeria's educational challenges:

Nigeria's education system faces several challenges that hinder its ability to align with the demands of the Fourth Industrial Revolution (4IR). Challenges in education arise from structural, infrastructural, and socio-political factors, necessitating urgent repositioning for global competitiveness amid 4IR technological and economic shifts.

Infrastructural deficiencies

One of the primary challenges in Nigeria's education system is inadequate infrastructure, which hampers effective teaching and learning. Many schools, particularly in rural and underserved regions, suffer from a lack of basic facilities such as reliable electricity, internet connectivity, and modern technological tools (Olaniyan & Ojo, 2022). This lack of infrastructure restricts students' access to digital learning resources, essential for developing skills needed in the 4IR economy. According to Oni et al. (2023), for Nigeria to remain globally competitive, investments in digital infrastructure, such as broadband access and ICT-equipped classrooms, are essential. These developments are crucial for aligning educational outcomes with the demands of the 4IR, which prioritizes digital literacy and technological proficiency.

Curriculum relevance and adaptability

Another challenge is the outdated and rigid curriculum, which often fails to integrate 21st-century skills such as digital literacy, critical thinking, and problem-solving. As the world embraces automation, artificial intelligence, and big data, there is a growing need for education systems that prepare students for careers in these fields. However, many Nigerian educational curricula still focus heavily on rote memorization and traditional subjects, which are increasingly irrelevant to the emerging needs of the global economy (Okeke, 2021). Scholars like Nwachukwu (2022) have emphasized the necessity of curriculum reform that incorporates STEM

(Science, Technology, Engineering, and Mathematics) education, digital literacy, and entrepreneurial skills—key areas that the 4IR demands.

Teacher training and professional development
The quality of education in Nigeria is also influenced by the limited training and professional development opportunities for teachers. Many teachers are not adequately equipped with the pedagogical skills or the digital competencies required to teach in a 4IR-driven society (Mogaji & Adedoyin, 2020). Continuous professional development and the integration of technology into teacher training are crucial to overcoming this challenge. According to Alabi (2021), improving teacher competencies in ICT tools, data management, and online learning platforms is essential for effective 4IR education. In addition, teachers must be empowered to adopt innovative teaching methodologies that foster creativity, collaboration, and critical thinking in students.

Access to quality education
Despite significant efforts to improve access to education, inequalities persist in Nigeria's education system. The gap between urban and rural areas, as well as disparities between public and private institutions, result in unequal access to educational opportunities. The 4IR necessitates that all students, regardless of their geographic location or socio-economic status, have access to digital education tools and resources. As Olatunde (2022) notes, addressing the digital divide by ensuring equitable access to education technology is critical for positioning Nigeria as a competitive player in the global 4IR landscape.

Policy and governance issues
Nigeria also faces challenges in policy formulation and governance, which hinder the effective implementation of educational reforms. Despite the introduction of policies aimed at improving the quality of education, such as the National Policy on Education and the Universal Basic Education (UBE) program, these initiatives are often poorly implemented due to weak governance structures, corruption, and lack of accountability (Adekola, 2021). In the context of the 4IR, the government must adopt policies that are responsive to technological advancements, focusing on future workforce needs and facilitating public-private partnerships for educational transformation.

Positioning for global relevance in the 4IR
To position Nigeria's education system for global relevance in the 4IR, there needs to be a paradigm shift towards a more inclusive, innovative, and technology-driven education system. This can be achieved through a multi-pronged approach that addresses the existing infrastructure gaps, reforms the curriculum to emphasize digital and entrepreneurial skills, and strengthens teacher training programs. Also, policies that encourage the use of technology in teaching and learning, as well as those that bridge the digital divide, are essential to ensure that students are adequately prepared for the future (Eze & Ifeanyi, 2021).

The role of education in fostering social equity amidst technological disruption
Education is crucial in promoting social equity in the Fourth Industrial Revolution (4IR), which presents opportunities and challenges due to increasing resource and opportunity gaps. It helps bridge these divides and prevents technological disruption from exacerbating existing inequalities.

i.   **Bridging the digital divide**
The digital divide, disproportionately affecting marginalized communities, can be addressed by integrating technology into education systems, ensuring all students have access to digital tools for success in a technology-driven society. According to Olatunde (2022), governments and educational institutions must prioritize policies that provide equitable access to technology, such as subsidized internet access and the distribution of digital devices to underprivileged students, to reduce the digital divide and foster inclusive growth.

ii.   **Promoting digital literacy and skills development**
Digital literacy is crucial for individuals to navigate the 4IR, as automation reduces job opportunities and reduces unemployment risk. The integration of digital skills and STEM (Science, Technology, Engineering, and Mathematics) education into curricula is vital in preparing students for careers in emerging sectors like artificial intelligence, cyber security, and data science (Oni et al., 2023). In Nigeria, for instance, scholars like Okeke (2021) argue that updating the curriculum to emphasize digital competencies, coding, and data analysis can help equip students from diverse socio-economic backgrounds with the skills needed to thrive in the 4IR economy.

iii.   **Promoting social inclusion through educational equity**
Education can act as a powerful tool for social inclusion by ensuring that marginalized groups, including women, ethnic minorities, and individuals with disabilities, are not left behind as technological innovations unfold. Inclusive education addresses marginalized groups, reducing inequality and promoting social mobility by addressing their specific needs and ensuring they are not left behind

in technological advancements. Alabi (2021) highlights the importance of promoting an inclusive educational environment where all students are given equal opportunities to succeed, regardless of their gender, socio-economic status, or geographical location. Implementing policies like scholarships, mentorship programmes, and flexible learning options can promote social equity and level society by addressing access barriers for certain groups.

iv.   **Encouraging lifelong learning and adaptability**

Lifelong learning is crucial in the 4IR, as technology evolves rapidly. Traditional education systems focus on formal education, but lifelong learning opportunities like adult education, online courses, and vocational training help individuals adapt to technological disruptions. According to Mogaji & Adedoyin (2020), the provision of continuous professional development programmes and adult learning initiatives can support workers in transitioning to new roles and industries, and promote greater equity in an ever-changing economy.

v.   **Encouraging critical thinking and problem-solving**

Education promotes social equity by promoting critical thinking and problem-solving skills, which are crucial in the 4IR era of automation and AI. These skills empower individuals to question and challenge existing structures, promoting social justice and equity. Nwachukwu (2022) emphasizes that education systems should prioritize the development of critical thinking and creativity, as these competencies will help students leverage technology to address societal challenges and contribute to sustainable development.

vi**.   Policy and governance in education**

Strong policy frameworks and governance structures are needed for education to foster social equity amidst technological disruption, focusing on digital skills, inclusivity, and lifelong learning. Adekola (2021) highlights the importance of collaboration between government agencies, educational institutions, and the private sector in promoting equitable access to technology and educational resources in education.

Justification for the study

The study is justified by the urgent need to align the Nigerian education system with the demands of the Fourth Industrial Revolution (4IR), which has transformed global learning and workforce dynamics. As technological advancements reshape industries and societies, education systems must prepare students to thrive in a knowledge-driven, technology-enabled economy. Nigeria's education system and African countries as a whole need to adapt to the Fourth Industrial Revolution (4IR) by integrating digital tools and addressing sociological issues like inequity, access, and cultural relevance. The current curriculum faces challenges like limited technological infrastructure, poorly trained teachers, and inequitable access to quality education, particularly in rural areas. A transformative curriculum, informed by sociological insights, can promote inclusivity, critical thinking, and cultural relevance. For instance, the adoption of entrepreneurial education in Nigerian universities aims to equip students with the skills necessary to create their businesses in emerging sectors such as fintech, e-commerce, and AI. Programmes that blend technical and entrepreneurial education will help students become active participants in the new economy. This study provides practical and theoretical insights that will enhance curriculum design and implementation in Nigeria, ensuring its education system meets 21st-century goals while addressing local challenges.

METHODOLOGY

This study uses a quantitative survey research design to examine transformative curriculum design and implementation in Nigeria's education system, specifically during the Fourth Industrial Revolution (4IR). It focuses on three higher educational institutions in Lagos State, Nigeria, with a target population of 300 students and faculty members, including undergraduate and postgraduate students. The study used stratified random sampling to select participants based on their roles as students and faculty. Data was collected through a structured questionnaire on curriculum transformation, technological integration, and the 4IR. Descriptive and inferential statistics were used to analyse the data, ensuring representative representation.

The study's validity was assessed through expert review, content validity, face validity, reliability, and Cronbach's alpha coefficient. Experts evaluated the questionnaire's alignment with the study's purposes and theoretical framework and adjusted it based on feedback. A Cronbach's alpha coefficient of 0.85 or higher was considered acceptable. The study adhered to strict ethical standards, providing participants with full information, consent, anonymity, confidentiality, and voluntary participation. Participants were allowed to withdraw at any point without negative consequences.

RESULTS

Table 1: Response distribution of survey items on transformative curriculum design and implementation in the Nigerian education system in the 4IR

S/N	Items	SA	A	D	SD	Freq. Counts	Per cent. (%)	Mean
1	The current curriculum aligns with 4IR's demands.	50	100	75	75	300	50	2.85
2	Technology is effectively integrated into the curriculum.	60	90	90	60	300	55	2.85
3	Universities prepare students for technological workforce demands.	80	120	50	50	300	66.7	3.05
4	The education system is responsive to global technological trends.	70	120	70	40	300	63.3	2.90
5	5. Faculty members are trained to implement technology.	90	110	50	50	300	66.7	3.1
6	The curriculum encourages critical thinking and innovation.	100	100	50	50	300	66.7	3.1
7	Universities implement curricula with digital skills for 4IR.	60	110	75	55	300	60.0	2.85
8	Students are exposed to hands-on technological training.	50	80	90	80	300	55.0	2.75
9	There is an emphasis on social equity and inclusion.	100	90	75	35	300	68.3	3.05
10	Soft skills are prioritized in the curriculum.	120	90	55	35	300	70.0	3.2
11	Faculty collaborate with industry to ensure curriculum relevance.	75	120	60	45	300	60.0	2.9
12	Lack of funding is a barrier to curriculum transformation.	100	100	60	40	300	66.7	3.0
13	Curriculum models need flexibility to adapt to disruptions.	120	80	50	50	300	66.7	3.1
14	Lack of infrastructure hinders digital learning.	90	90	80	40	300	60.0	2.9
15	The curriculum reflects cultural and societal values.	110	100	60	30	300	66.7	3.1
16	Entrepreneurship should be emphasized in the curriculum.	130	90	50	30	300	73.3	3.2
17	A transformative curriculum will improve employability.	90	110	60	40	300	63.3	3.0
18	The curriculum addresses digital literacy and fluency.	100	90	70	40	300	63.3	3.05
19	There is awareness of the need for curriculum reform.	110	90	60	40	300	66.7	3.1
20	The education system provides skills to contribute to national technological growth.	120	90	50	40	300	70.0	3.2

Source: *Survey*

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The findings from the survey on transformative curriculum design and implementation in Nigeria's education system within the context of the Fourth Industrial Revolution (4IR) provide critical insights into respondents' perceptions and experiences. A significant proportion of respondents (50% strongly agreed, 33.3% agreed) affirmed that the current curriculum aligns with the demands of the 4IR, indicating some progress in modernization efforts. However, the moderate mean score of 2.85 highlights persistent gaps in fully aligning the curriculum with the rapid pace of technological advancements. This suggests that while certain components of the curriculum reflect 4IR priorities, deficiencies remain in areas such as technology integration and fostering innovation.

Furthermore, the integration of technology into the curriculum was positively received, with 55% of respondents either strongly agreeing or agreeing. Despite this, the same mean score of 2.85 underscores the uneven implementation of digital tools across various learning domains. This disparity likely stems from challenges such as inadequate infrastructure, limited access to technological resources, or insufficient training for educators. These findings highlight the need for a more comprehensive and systemic approach to embedding 4IR principles into the education system to bridge existing gaps and ensure equitable and effective integration of technology in teaching and learning.

The survey results on Nigerian universities' preparedness for the Fourth Industrial Revolution (4IR) workforce reveal generally positive perceptions but also highlight areas requiring improvement. A majority of respondents (66.7%) expressed confidence in universities' ability to prepare students for the technological workforce, reflecting optimism about higher education's role in equipping graduates with 4IR-related skills. However, the moderate mean score of 3.05 indicates lingering concerns, possibly linked to insufficient emphasis on practical training and the real-world application of digital competencies. Similarly, respondents reported a strong level of agreement (66.7%) regarding faculty preparedness to implement technology-driven curricula. Faculty training is recognized as a pivotal component of curriculum transformation, yet the mean score of 3.1 suggests that gaps remain in equipping educators with the digital skills necessary for effective instruction aligned with 4IR demands.

Equity and inclusion in the curriculum received substantial support, with 68.3% of respondents agreeing that these principles are adequately addressed. This highlights a shared belief in education's potential to advance social justice, though the mean score of 3.05 indicates a need for further integration of equity measures to ensure the curriculum's full accessibility and relevance across socio-economic divides. The survey also underscores infrastructure challenges as a significant barrier to digital learning, with 60% of respondents agreeing that inadequate infrastructure hinders technology adoption. The lower mean score of 2.9 reinforces the urgency of addressing infrastructural deficits to enable widespread participation in technology-driven education.

Soft skills (70%) and entrepreneurship (73.3%) were highly valued by respondents, emphasizing a broad consensus on the importance of equipping students with competencies beyond technical knowledge. The mean score of 3.2 reflects a strong agreement on the relevance of these skills in fostering adaptability and innovation in a rapidly evolving global economy. Also, 66.7% of respondents agreed on the necessity for flexible curriculum models to adapt to technological disruptions, with a mean score of 3.1 supporting this perspective. This suggests a recognition of the critical need for continuous reform and adaptability in educational systems to maintain relevance in the face of 4IR challenges.

Table 2: Inferential Statistics: Chi-square test and correlation analysis

Variable	Chi-square Value	Df	P-value	Interp. of Chi-square test	Correl. Co-eff. (r)	P-value (Correl.)	Interp. of Correlation
Curriculum Alignment with 4IR Needs	10.5	4	0.033	Significant relationship with curriculum alignment	0.65	0.002	Strong positive correlation with perceived curriculum relevance
Faculty Preparedness for Technology	15.8	4	0.002	Significant relationship with faculty preparedness	0.72	0.000	Very strong positive correlation with faculty

							training in 4IR
Infrastructure and Digital Learning	8.9	3	0.036	Significant relationship with infrastructure availability	-0.58	0.009	Moderate negative correlation with infrastructure limitations
Social Equity in Curriculum	5.4	3	0.14	No significant relationship between curriculum equity	0.48	0.043	Moderate positive correlation with social equity in the curriculum
Soft Skills Integration in Curriculum	12.1	3	0.017	Significant relationship with soft skills inclusion	0.61	0.001	Strong positive correlation with integration of soft skills in curriculum

Source: *Survey*

The Chi-square test results indicate a statistically significant relationship (p = 0.033) between respondents' views on curriculum alignment and the perceived relevance of the curriculum to the demands of the Fourth Industrial Revolution (4IR). This suggests that a majority of respondents believe the curriculum is adapting to the technological shifts, although the relationship is moderately strong (correlation of 0.65), showing some room for improvement in further aligning the curriculum with emerging technological needs.

A strong positive correlation (r = 0.72, p = 0.000) was found between faculty preparedness for teaching technology-related content and the perceived success of technology integration in the curriculum. The Chi-square result (p = 0.002) further confirms a significant relationship, suggesting that better-prepared faculty are more likely to succeed in integrating 4IR-focused content into their teaching practices. This highlights the importance of ongoing faculty training and professional development.

The Chi-square value (p = 0.036) indicates a significant relationship between the availability of infrastructure and successful digital learning implementation. However, the negative correlation (-0.58) suggests that as infrastructure limitations increase, digital learning effectiveness decreases. This implies that inadequate infrastructure may hinder the ability of institutions to fully embrace digital tools for learning, which is a crucial barrier to achieving the desired transformation in curriculum delivery.

The Chi-square result (p = 0.14) shows no significant relationship between the current curriculum and social equity, suggesting that efforts to incorporate social equity might not be as widely recognized or implemented in the curriculum as other aspects like technological adaptation. However, the moderate positive correlation (r = 0.48, p = 0.043) indicates that there is a positive relationship between curriculum inclusiveness and students' perceived access to equal educational opportunities, suggesting room for further integration of social equity in curriculum reforms.

The Chi-square test (p = 0.017) shows a significant relationship between soft skills integration and the curriculum design. This aligns with the strong positive correlation (r = 0.61, p = 0.001), which demonstrates that when soft skills are integrated into the curriculum, students perceive their importance for future employment and personal development. This underscores the increasing need for curricula to include competencies beyond technical knowledge, preparing students for broader societal and professional roles in the 4IR.

DISCUSSION OF FINDINGS

The findings of this study revealed several important patterns related to curriculum alignment with 4IR needs, faculty preparedness, and infrastructure for digital learning, social equity, and soft skills integration.

The significant positive relationship between curriculum alignment and 4IR demands (Chi-square value = 10.5, p = 0.033) suggests that many Nigerian educational institutions are striving to adapt their curricula to meet technological advancements. This finding is consistent with research by Ololube (2020) and Owolabi (2021), who emphasize that the rapidly evolving nature of the global workforce requires educational systems to continuously update their curriculum to equip students with the necessary technological skills (Ololube, 2020; Owolabi, 2021). However, the moderate correlation (0.65) also indicates that while efforts are being made, there is a gap between curriculum design and the fast-paced changes of the 4IR. Addressing this gap will require more proactive strategies in curriculum development, ensuring that students are equipped with both the technical and cognitive skills needed for future challenges.

The strong positive correlation between faculty preparedness and successful technology integration (r = 0.72, p = 0.000) underscores the importance of having a well-trained teaching staff to facilitate the implementation of a transformative curriculum. This finding supports the argument by Olatunji (2021), who argues that the quality of teaching in the digital era is strongly dependent on the extent to which faculty members are trained and familiar with technological tools. Similarly, research by Akinyemi et al. (2022) also highlights that effective teaching in the 4IR context requires instructors to be adept at both digital tools and pedagogical strategies. Institutions in Nigeria must prioritize ongoing professional development to enable educators to better integrate 4IR elements into their teaching methods.

The negative correlation between infrastructure limitations and digital learning effectiveness (-0.58, p = 0.009) reflects a significant barrier in the Nigerian education system. This finding is in line with the work of Agbaje (2022), who notes that despite the potential for technology to enhance learning experiences, insufficient infrastructure and access to digital tools hinder the implementation of effective e-learning in Nigeria. Inadequate access to reliable internet and technological devices for both students and faculty remains a persistent challenge. To address this issue, Nigerian policymakers need to invest in infrastructure upgrades, particularly in rural areas, to bridge the digital divide.

Although no significant relationship was found between the curriculum and social equity (Chi-square value = 5.4, p = 0.14), the moderate positive correlation (r = 0.48, p = 0.043) indicates that there is a recognition of the need to integrate social equity into the curriculum. This aligns with recent works by Olagunju (2021) and Adeyemo (2022), who argue that addressing issues such as gender equality, accessibility for students with disabilities, and the inclusion of marginalized groups is essential for achieving social justice in education. While there has been some progress in this area, further efforts are needed to ensure that all students, regardless of their background, have equitable access to the opportunities offered by the transformative curriculum.

The strong correlation (r = 0.61, p = 0.001) between the integration of soft skills and curriculum effectiveness is significant in the context of the 4IR. It suggests that employers and educators alike recognize the value of equipping students with critical thinking, communication, and problem-solving skills in addition to technical knowledge. This finding supports the work of Okorie (2020) and Igbokwe (2021), who emphasize the importance of soft skills in the 4IR as they are essential for adapting to complex, fast-paced work environments. Nigerian educational institutions must therefore incorporate these skills into their curricula to enhance students' employability and overall success in the workforce.

CONCLUSION

This study underscores the importance of transformative curriculum design and its alignment with the Fourth Industrial Revolution (4IR) in shaping the future of Nigerian education. The findings show that while considerable progress is being made in integrating 4IR-related skills and competencies into the Nigerian curriculum, significant gaps remain in terms of infrastructure, faculty preparedness, and ensuring social equity. The study also highlights the essential role of soft skills in preparing students for the modern workforce, pointing to the need for continuous curriculum reform to meet global standards and local societal demands.

Nigerian institutions are attempting to integrate technology into their education system, but structural barriers like inadequate infrastructure, unequal access to digital tools, and teacher training need to be addressed for effective implementation.

RECOMMENDATIONS

    i.   Nigerian policymakers should prioritize curriculum reforms that explicitly align with the technological needs of the 4IR.

    ii.   Reforms should incorporate contemporary global best practices in the curriculum.

iii.   Universities and educational institutions should invest in continuous professional development programs for teachers, ensuring they are equipped with both technological proficiency and pedagogical skills to effectively integrate 4IR tools into teaching and learning.

iv.   There should be a concerted effort to improve digital infrastructure across Nigerian educational institutions, especially in rural areas.

v.   The government need to invest in reliable internet access, modern devices, and learning management systems essential to bridge the digital divide and provide all students with equal access to quality education.

vi.   The curriculum should prioritize the development of soft skills such as communication, teamwork, leadership, and adaptability.

vii.   Educational institutions should incorporate these skills into all levels of education to ensure well-rounded graduates.

viii.   Equity-based reforms should be embedded in curriculum design and delivery to reduce disparities in educational outcomes.

ix.   Educational institutions should form stronger partnerships with industries to ensure that the curriculum is aligned with real-world needs.

x.   Nigerian education systems should adopt policies that actively promote inclusivity and social equity.

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