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REVOLUTIONIZING EDUCATION: HARNESSING INNOVATIVE PEDAGOGIES FOR 21ST CENTURY

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We thank God for His boundless mercies, protection, and love guiding our endeavours to scholarly pursuit and excellence.

Dr. Jane Ihuaku Asonze
Chairperson,
Association of Women in Colleges of Education,
Zuba Abuja Chapter.

EDITORS NOTE

JOWICE (ISSN: 2315 - 6694) is the official journal of the National Association of Women in Colleges of Education FCT Zuba Abuja Chapter. The journal's scholarly contribution and significance continue to expand, and this edition represents yet another important turning point in our joint task to increase our contribution to knowledge of principles and evidence-based practices in the education system.

In Nigeria, and other developing countries, there is a dire need for pedagogical innovations for the transformation of the educational landscape. This could be achieved by utilizing strategies and skills which are necessary for meaningful participation in contemporary societies. This informed the choice of this edition of the journal themed **"REVOLUTIONIZING EDUCATION: HARNESSING INNOVATIVE PEDAGOGIES FOR THE 21ST CENTURY"**

In this edition, papers have carefully examined, all of which provide insightful analyses on the current theme from the 2nd National Conference and Workshop of the association held at FCT College of Education Zuba from 16th to 17th of June, 2025. These papers highlight the journal's dedication to supporting and advocating for innovative studies that bring solutions to issues in educational dynamics.

As the Chief Editor, I hereby tender a proud appreciation to our editorial board, reviewers, and contributing authors and distinguished scholars for their priceless efforts in this regard. This publication is the result of your professional dedication and scholarly honesty. I also want to express my gratitude to our readers, whose ongoing influence and propositions are indispensable to the development and enhancement of this publication. We are still dedicated to maintaining the best standards of academic publishing.

Dr. Nwabueze Josephine N.

Editor - in - Chief

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REVOLUTIONIZING EDUCATION: HARNESSING INNOVATIVE PEDAGOGIES FOR 21ST CENTURY STUDENTS

By

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Abstract

Educational reform is an ongoing discuss in the educational system of nations across the world and it is a continuous evaluation that must be carried out from time to time as the society is evolving and education being an integral part must not be static. As the demands of the twenty-first century evolve, so too must our approaches to teaching. Teacher educators play critical roles in shaping educators who are not only responsive to change but also capable of leading it. Therefore, the paper discussed the rationale for revolution in education in modern society with emphasis on innovative pedagogies which promise to help in the delivery of knowledge content in an inclusive, student-centered, collaborative way, with the integration of modern technologies. It also highlighted types of innovative pedagogies vital in equipping learners with the skills necessary for a twenty-first century student. The attitude of teachers was also examined and explained that for innovative strategies/methods to be adopted by teachers, a growth mindset is essential as against the fixed mindset. The recommendations suggested include: Nigerian educational system should undergo reform in order to conform with the twenty-first century educational practices, innovative teaching strategies which promote effectiveness in teaching and learning should be explored by teachers and students should be engaged as co-creators of their learning journey.

Keywords: Education, Reform, Innovative pedagogies, Skills, Mindset

Introduction

The current reality of modern society with the advent of technology has left much to be desired especially in the area of education. Hence, there is need for a more inclusive education that can meet the need of the society and industries as well. Eslit (2023), explained that in today's rapidly evolving world, education plays a pivotal role in preparing students for the challenges and opportunities they will encounter in the 21st century. Also, traditional teaching methods are no longer sufficient to equip students with skills and competencies necessary for success in an increasing complex and interconnected world.

Nations that have witnessed positive turn around in their industrialization and economic growth, all started by giving top priority to the education of her citizens, starting from primary to tertiary level. It will be difficult to discuss the issue of educational revolution in a rapidly changing world without considering the necessary reform and innovation which can produce standard. Oladeji (2023), stated that there is no doubt that for growth and development to be recorded, reform and innovation are prerequisites. Hence, many countries are adopting strategies that promote creativity in students and transforming education to be all inclusive and student-centered.

There is a global paradigm shift in education from teacher-centered classroom to student-centered classroom and from knowledge acquisition to skill-acquisition. Furthermore, the education expected today is the one that makes the learner a global citizen armed with the necessary skills needed to navigate the challenges of modern time in various fields of endeavour. Moreover, Akudolu (2012), stated that educationists all over the world are making frantic efforts to realign educational

endeavors to equipping learners with the necessary skills and competencies for an effective life in a knowledge dominated society.

A new generation of learners have grown up connected. The virtual world knows none of these artificial boundaries and as populations and cultures increasingly evolve, connect, move and merge, there are questions of equity, identity, diversity and inclusion. Everyone's voice can now be heard. Learnlife (2021).

Therefore, there is need to transform education to cater for the twenty first-century student whose exposure rate is very high, and to make education relevant and such that can equip the learner with the necessary skills needed to navigate the twenty-first century landscape. To achieve this, the mode of instruction must be critically examined, especially in the area of pedagogy. Teaching methods and strategies that involve creativity, collaboration and promote critical thinking must be encouraged and adopted to build an educational system that can withstand the test of time in this period in history. Therefore, the use of strategies that can combined face-to-face classroom with online learning are brought to the fore.

Accordingly, Loader (2010), opined that we need education revolution to enable learning to become part of our lifestyle. That means we need assessment not by way of an external examination but rather through evidence of coping with an increasingly complex world. Similarly, we need a curriculum focused not on know-what, straightforward factual knowledge. The curriculum needs to be increasingly directed towards know-why, know-how and know-who; knowledge that will equip young people for rapid changes in job-related knowledge requirements, and greater complexity and diversity of path-ways through adult life.

The rationale for educational revolution

- **Societal expectation:** The educational system of any society is not a stand along entity, but it is interrelated with other sub-sectors. Teachers Institute (2023) explained that education is much more than a classroom experience. It is a dynamic system that operates within the broader societal framework, interacting with the various subsystems like politics, culture, economy and family. Accordingly, education is essential in promoting the social and economic status of the individuals. Therefore, any education that cannot enhance the ability of individuals to adapt adequately in their environment and place them at a financial state where their basic needs can be met is inadequate. In line with Rumjaun (2019), the twenty-first century education puts a great deal of emphasis on preparing students for employability in the current global economy. Also, as the world is fast changing in many areas, technology is evolving and to have a relevant education that will meet the need of the community, especially in the area of technology, there is need for revolution. The teaching-learning process must be reviewed in order to be relevant in modern society.

- **Students' interest and needs:** Students have different characteristics in terms of their capabilities and learning style. The twenty first century learner in the digital age has a lot of information at hand just at the press of a button. "Learners are expected to have personal learning pathways that reflect their different interests, aspirations and learning styles" Loader (2010). In order to enhance their learning, they must be fully involved in class to meet their needs and cope in a changing society or else they will be operating at different levels from their teachers.

- **Technological advancement:** The digital age has transformed education beyond imagination. The availability of diverse digital tools and online resources has made teaching and learning more involving, giving room for inclusive education. Technology is evolving and so is the way students learn with these technologies. New technology fosters different types of interactions and new ways of learning. The impact of technology, the internet and the changing nature of students is making past teaching styles less effective, Loader (2010). Also, the internet has revolutionized the world, and that includes the world of education (Walden University, 2025). However, there are lots of concerns about the use of technology by learners. Students ought to learn not just how to use technology, but also how to make informed decisions about technology (Pleasant, Clough and Olson, 2019). Pleasant et al (2019), also listed out some questions we need to ask about the nature of technology in order to take informed decision. Some of which are: How does technology affect the way people think and act? How does technology impact society? How should technologies be evaluated? What is the proper perspective to take on technology?

- **School outside the wall of the classroom**: School is no longer limited by wall, it is accessible and available everywhere. Meaning that learning has become personalized where learners interface with the knowledge content on the web. Learners also determine what they learn and how they learn. Institutions must wake up because the preference for online school has become a great option to students, especially older students and the working class. Schools are using Learning Management System (LMS) in addition to the physical classroom. Learning is becoming easier and at learners pace. Open and distance learning schools are been opted for, because of flexibility and it is currently pulling crowd in Nigeria. Apart

from the National Open University of Nigeria which is government owned, there are others. The implication for reform is that schools as a matter of necessity should change their modes of instruction to include and integrate technology, using the face-to-face mode and the online mode such as blended learning approaches. Corroborating this, TeachersInstitute (2023), stated that in today's digital age, technology plays a crucial role in expanding the possibilities for learning outside the school walls. Online platforms, digital tools, and social media provide students with access to a wealth of knowledge, expert opinions, and peer collaboration from all over the world. Learning is no longer confined to the classroom.

- **Changing roles of teachers:** As the world is evolving, so also are the roles of teachers. The role of a Teacher is changing from that of a person who is a pool of knowledge, standing in front of the class to disseminate knowledge, to that of a learning guide, facilitator of knowledge, mentor, coach etc. The twenty-first century teacher is the "educator beyond the gate". He can facilitate learning either in physical class or online in real time or by sending materials before or after the class for students to access. To corroborate this, Rumjaun (2019), explained that teachers need to be empowered as facilitators and motivators of learning. They need to be forward thinkers, curious and flexible. They must also be learners, learning new ways of teaching and learning alongside their students. Hence, there should be emphasis on teacher professional development. Some of the roles of the twenty-first century teachers as stated by Sardar (2018), include facilitators of learning, technology integration, personalized learning, lifelong learners, cultural competence, mentors and guides, collaboration with stakeholders, focus on soft skills and global awareness.

- **Lifelong learning:** The focus of education is changing from just acquisition of knowledge to education that can sustain the individual throughout life. That is, the educated is continuously learning, a self-initiated education for personal and professional development so as to adapt and be relevant in the ever-changing world. People can no longer navigate their course using knowledge acquired at school, college or university. They need to learn throughout life. Lifelong learning is an effective and transformational means of tackling current global challenges, (UNESCO,2025). Hence, in order to cope with the changing society and the curriculum, the 21st century teachers should as much as possible, unlearn, learn and relearn.

Twenty-first century skills

A lot has been said and published about the skills needed by students to navigate and be relevant in the twenty-first century. These skills are expected to be taught and learnt during the process of schooling, as the students are meaningfully engaged in activities that can promote these skills. Omission of the very necessary ones can make the students ill-equipped.

The following framework was designed by Partnership for twenty-first century learning (P21), which has been advocating for the inclusion of 21st century skills into education. The P21 was founded in the US in 2002 by many organizations from the industries, technology companies, policymakers and educators. The P21 (2016) framework for 21st century learning was developed with input from educators, education experts, and business leaders to define and illustrate the skills, knowledge, expertise, and support systems that students need to succeed in work, life, and citizenship. Hence, graduates

that are better prepared to thrive in today's digitally and globally interconnected world. They grouped the skills into three major parts as follows:

1. Learning and innovation skills

These skills consist of the 4Cs

• Creativity and Innovation

• Critical Thinking and Problem Solving

• Communication

• Collaboration

2. **Information, media and technology skills**

These skills are essential in a technology and media-driven world

• Information Literacy

• Media Literacy

• ICT (Information, Communications and Technology) Literacy

3. Life and career skills

These skills are the habits and mindsets that students should develop. Some of these skills are internal, while others are based on interactions with others.

• Flexibility and Adaptability

• Initiative and Self-Direction

• Social and Cross-Cultural Skills

• Productivity and Accountability

• Leadership and Responsibility

Innovative pedagogies

Innovative pedagogies are the modern strategies and methods by which teachers present learning materials to students in a way in which students are engaged as they participate actively and collaborate with other students. Accordingly, Udoh (2017), stated that in order to enhance the quality of teaching and learning in the classroom, the traditional teaching approaches which are teacher-centered and may not provide students with valuable skills or even provide the students with a body of knowledge that last much beyond the classroom must be discouraged.

Furthermore, the twenty-first century hold many promises which the learners must key into for self development and for lifelong learning that is sustainable in an ever changing world. Hence, it is imperative for teachers to adopt the innovative pedagogies in order to meet the demands of students and the society in this century. Pedagogy includes the approach, methods and strategies of teaching in addition to the theories and the evaluation of the teaching/ learning process. Ayantunji, Olatoye & Ileuma (2024) stated that the integration of twenty-first century pedagogies hold immense promise for advancing education and will benefit learners to meet up in an ever-changing world. "The future of education lies in the continued pursuit of innovation. As new technologies emerge and our understanding of effective teaching and learning evolves, the possibilities for revolutionizing education are limitless. By embracing change and experimenting with new approaches, educators can create learning environment that are not only more effective but also more inclusive, engaging and relevant to the needs of today's learners" (Inventor-e, 2025).

Features of innovative pedagogies

- Student-centred which involves the active participation of learners.
- Technology-driven: the use of digital tools and online class.
- Collaborative: affords students to work in group.
- Community-based: the type of pedagogy that is tailored to societal needs.
- Inclusive: strategy that can take care of different categories of learners based on learning style and can meet their diverse needs.
- Prompt feedback: the pedagogy should not only provide assessment for teacher's purpose but also focus on student-based assessment.

Types of innovative pedagogies

There are many innovative pedagogies which can foster and promote the twenty-first century skills and some will be listed in this paper. In selection of any pedagogy, teachers should have at the back of their minds, the following important factors: achieve the lesson objectives, students-centered involving active participation of learners, technology-driven, community based, enhance collaboration among students or give prompt feedback. In this paper, some of the innovative pedagogies will be discussed. These include: active learning, collaborative learning, technology integration, gamification, personalised learning (Diddi & Nirappel, 2023) and experiential learning. These pedagogies can be grouped as follows for clarity.

Table 1.1 Types of innovative strategies with examples

S/N	Innovative Strategies	Form/Example
1	Active Learning	Problem-based learning, Project-based learning
2	Collaborative Learning	Peer-to-peer learning, jigsaw, team project
3	Technology Integration	Blended learning, flipped classroom, Technological, Pedagogical And Content Knowledge (TPACK). Use of AR and VR, use of smart board, power point and other digital devices.
4	Gamification/Game Based Learning	Duolingo/ minecraft computer games, video games, card games, board games, word games
5	Personalized Learning	Place-based education, competence-based learning/Mastery learning .
6	Experiential Learning	Internship, field studies, laboratory, workshop, studio work, simulations and role-play.
7	E-Learning	Online learning: the use of virtual class such as google classroom, Google Meet, Microsoft Teams, Zoom etc Learning Management System (LMS)

Framework for selection of innovative pedagogical approaches

There are guidelines that should be considered by teachers in selecting innovative pedagogical, these include: the relevance of the approach to learning objective of lesson, Pedagogies that involve giving of prompt feedback, promote active engagement

of learners, enhances cooperation and collaboration among students, maximize students ability and interest. In giving the framework for selection of innovative pedagogical approaches, Herodotou, Sharples, Gaved, Kukulska-Hulme, Rienties, Scanlon & Whitelock (2019), listed the following:

a) Relevance to effective educational theories

b) Research evidence about the effectiveness of the proposed pedagogy

c) Relation to the development of 21st century skills

d) Innovative aspects of pedagogy

e) Level of adoption in educational practices

Challenges to the use of innovative pedagogies in nigerian schools

1. Lack of expertise by teachers in the area of technology and innovative pedagogies due to lack of or insufficient teacher professional development.

2. Lack of fund to procure digital tools in schools. This is due to insufficient funding allocated to education in national budget.

3. Lack of personal computer or smartphone by students which can be used for technology integrated teaching strategies such as blended learning, flipped classroom etc.

4. Inadequate security in schools to secure technological devices when purchased or donated

5. Epileptic power supply as we see in many places in Nigeria. Even if generator is available, the cost of fueling is high due to the removal of fuel subsidy by government.

6. Lack of internet facility or fluctuation of network which can disrupt teaching and learning with technologies.

7. Teachers' mindset: some teachers are not technologically inclined and hence, reluctant in adopting new methods of teaching, especially the ones that have to do with the use of digital tools.

8. Fixed sitting arrangement in classroom, which can hinder group discussion in class and hence discourage collaboration.

Mindset of teachers and the impacts on the choice of innovative pedagogies

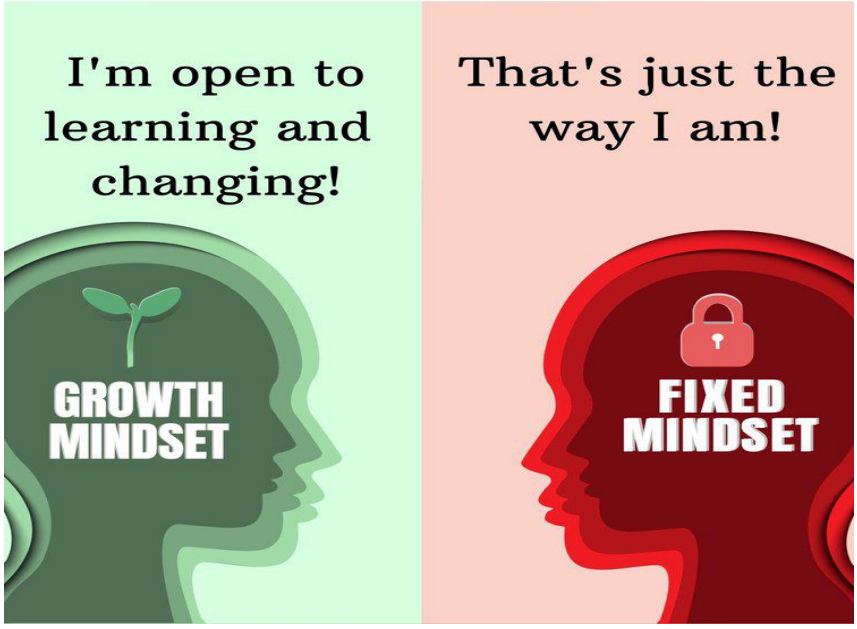
Deployment of Innovative teaching strategies starts with teacher's mindset. That means whether a teacher will utilize the innovative pedagogies or not, is the question of mindset. This has to do with belief and attitude of teachers in addition to the value they place on teaching. Thompson (2025) corroborates this by stating that innovative strategies starts with a growth mindset. "We are not born with our mindsets; we form them in response to many influences over time. Often our mindsets are unconscious, and we are unaware that they powerfully influence our thoughts, words and action" (Stoner & Stoner 2022). There are many mindsets but the two proposed by Carol Dweck in 2006 are considered below. These are the fixed mindset and the growth mindset.

Table 1.2: The characteristics of a fixed mindset and a growth mindset

Characteristics of a Fixed Mindset	Characteristics of a Growth Mindset
• Believes intelligence and talent are fixed	• Believes intelligence and talents can be developed
• Believes effort is fruitless	• Believes effort is the path to mastery
• Believes failures define who they are	• Believes mistakes are part of learning
• Hides flaws	• Views failure as an opportunity
• Avoids challenges	• Believes failures are temporary
• Ignores feedback	• Embraces challenges
• Views feedback as personal criticism	• Welcomes feedback
• Feels threatened by other's success	• Views other's success as inspirational

.

https://thepeakperformancecenter.com/development-series/mental-conditioning/mindset/fixed-mindset-vs-growth-mindset/amp/



Stoner & Stoner (2022).

Conclusion: As the industrial revolution is witnessing changes, so also is the educational system that is producing the workforce. In order for the system to remain relevant for the 21st century students, a lot of reform is needed in the sector. As the roles of teachers are changing, they must keep abreast with the best teaching strategies and methods that will make the classroom interactive, enhance students' collaboration, creativity and critical thinking. Teachers must keep learning for them to be relevant at this age. Technological tools, used in schools across the globe to facilitate learning should be procured and used in Nigerian public schools at all levels. Internet subscription should not only be for the school library but should be available in schools for both staff and students to have access. The education of today must empower students to live meaningfully in an ever-changing world. Therefore, there is strong advocacy for student-centered, community-based, lifelong education which could foster social and economic development of the nation. Consequently, the future of education lies in our willingness to innovate. By adopting innovative pedagogies, students can be empowered to thrive in an uncertain, fast-changing world.

Recommendations

Based on the foregoing, the following are recommended:

- The Nigerian educational system should undergo reform in order to conform with the twenty-first century educational practices
- There should be constant professional development for teacher educators to enhance their skills to keep up with the emerging trends in the educational system and help in adopting innovative pedagogies.
- Students should be engaged as co-creators of their learning journey.

- Schools can seek collaboration with the communities and organizations to obtain modern equipment.
- Government should increase budgetary allocation to education in order to set up infrastructure that will promote innovative pedagogies in schools, create better environment for teaching and learning and enhance the remuneration of teachers to meet up with the existing economic reality.
- Innovative teaching strategies which promise to enhance students' engagement in class, promote the acquisition of twenty-first century skills and increase academic outcomes should be explored by teachers.
- There should be equity in the educational system, whereby teachers are treated fairly among themselves, and diverse needs of students are catered for by the use of pedagogies that will enable them to learn maximally.

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ESSENTIAL SKILLS FOR PROFESSIONAL GROWTH: LEADERSHIP, PERSONAL DEVELOPMENT AND EFFECTIVE COMMUNICATION

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Abstract

Leadership, as a core driver of organizational and personal success, involves the ability to influence, motivate and guide others toward achieving shared goals. It encompasses vision-setting, decision-making, emotional intelligence and the capacity to inspire high performance in diverse teams. Closely linked to leadership is the concept of personal development, which refers to the conscious pursuit of self-improvement through learning, self-reflection, goal setting and skill acquisition. It enables individuals to adapt to changing professional demands and take ownership of their growth. Effective communication, both verbal and non-verbal, is equally crucial as it fosters clarity, collaboration, active listening and conflict resolution in professional settings. These three concepts form the foundation of essential skills required for professional growth. Their integration equips individuals to thrive in complex work environments, assume leadership roles and contribute meaningfully to organizational success. This paper concludes that continuous investment in leadership capabilities, personal development and communication proficiency is essential for career advancement. It recommends the implementation of structured training programs, mentorship initiatives and self-assessment tools to support skill development and long-term professional excellence.

Keywords: Professional Growth, Leadership skills, Personal Development and Effective Communication

Introduction

Professional growth is no longer driven solely by technical expertise; instead, it increasingly depends on soft skills that enhance an individual's ability to adapt, lead, collaborate and continuously improve. Among these, leadership, personal development and effective communication stand out as critical. These skills are not only valuable in management roles but are also essential across professions to foster innovation, teamwork and individual fulfillment (Robbins & Judge, 2023).

In today's rapidly evolving professional landscape, technical expertise alone is no longer sufficient for sustained career advancement. The demand for well-rounded professionals who can lead effectively, communicate clearly and engage in continuous self-improvement has become increasingly critical across all industries. Leadership, personal development and effective communication are now recognized as core competencies that not only enhance individual performance but also drive organizational success (Goleman et al., 2022).

Leadership in the modern workplace extends beyond traditional hierarchical roles. It encompasses the ability to influence, inspire and innovate within teams and organizations. Contemporary leadership theories highlight the importance of emotional intelligence, adaptability and collaborative decision-making in navigating complex, multicultural and dynamic work environments (Northouse, 2022). In particular, transformational leadership characterized by vision, motivation and ethical practice has been linked to higher employee engagement and improved performance outcomes (Bass & Riggio, 2019).

Equally important is personal development, which involves intentional efforts to enhance one's skills, mindset and overall well-being. Lifelong learning, self-reflection and goal setting are essential aspects of this growth process. Research shows that

professionals who invest in their personal development are more resilient, adaptable and capable of managing career transitions (Robinson & Stubberud, 2023). These qualities are increasingly valuable in a world where job roles and required skills are continually changing.

Effective communication remains the bedrock of successful interpersonal interactions and organizational functioning. The ability to convey ideas clearly, listen actively and respond empathetically enhances collaboration and reduces conflict. Furthermore, in an era of digital communication and remote work, mastering both verbal and non-verbal cues, as well as written and virtual communication tools is crucial (Cardon, 2023).

This paper explores these three essential skills, leadership, personal development and effective communication as pillars for professional growth. By examining their interdependence and practical application, the paper aims to equip participants with actionable strategies to enhance their career trajectory and contribute meaningfully to their organizations.

Concept of Professional Growth

Professional growth refers to the continuous process of acquiring new knowledge, improving existing skills and developing competencies that enhance an individual's performance, effectiveness and advancement in their chosen career. It encompasses formal and informal learning opportunities, including training, education, mentoring, self-directed learning and practical experience, all aimed at improving an individual's professional capabilities.

According to Noe et al., (2023), professional growth is not only critical for individual career advancement but also for organizational sustainability, as it contributes to workforce adaptability, innovation and productivity. It involves a proactive approach to self-improvement and a willingness to engage in lifelong learning.

Professional growth includes key dimensions such as skill development (technical and soft skills), leadership capacity, effective communication, goal setting and self-awareness. As stated by Robles (2022), soft skills like communication, leadership and adaptability are increasingly essential for professional growth, especially in today's rapidly changing work environments. Moreover, professional development plans and reflective practices are considered effective tools to guide growth and track progress over time (Zhao & Anand, 2021).

Concept of Leadership

Leadership is a dynamic and multifaceted process through which an individual influences a group of people to achieve common goals. It involves guiding, motivating and enabling others to contribute toward organizational or societal objectives (Northouse, 2022). At its core, leadership is not merely about holding a position of authority but about the ability to inspire, empower and drive change within groups or institutions. Leadership today, is viewed as a relational and context-dependent process that requires a blend of interpersonal skills, strategic thinking and ethical responsibility to address complex global challenges and foster collective progress. Leadership is more than a position it's a set of behaviour that inspire trust, foster collaboration and drive results.

Modern perspectives on leadership emphasizes the importance of adaptability, emotional intelligence and inclusivity. Goleman et al., (2017), argue that effective leadership increasingly requires emotional competence such as self-awareness, empathy and relationship management, especially in diverse and rapidly changing environments which underscores the need for leaders to be visionary, ethical and committed to developing their followers. A recent study by Avolio et al., (2024), also highlights the growing role of digital leadership in a technologically advanced world,

where leaders must be adept at managing virtual teams, leveraging data and navigating digital disruption. In addition, inclusive leadership, which values diversity and fosters a culture where all individuals feel respected and involved is gaining prominence as a crucial factor in organizational success (Shore et al., 2018).

Concept of Personal Development

Personal development refers to a lifelong process of self-improvement in knowledge, skills, behaviour and awareness, aimed at enhancing an individual's quality of life and realizing their full potential. It encompasses activities that improve self-awareness, identify and develop talents, build human capital and facilitate employability and overall well-being (McLeod, 2023). Personal development involves intentional efforts to improve self-awareness, self-regulation and overall effectiveness.

Personal development refers to conscious actions and strategies aimed at improving self-awareness, talents and potential (McLeod, 2023). It is a continuous, self-directed process that supports both personal satisfaction and professional success. Attributes like resilience, time management and a growth mindset are particularly relevant in evolving work environments (Illeris, 2018).

At the core of personal development is the belief that individuals have the capacity to evolve through intentional actions and reflection. The process often involves goal setting, self-assessment and continuous learning (Grant, 2017). According to Illeris (2018), personal development is not only cognitive but also emotional and social, indicating a holistic transformation that includes the individual’s identity and interactions with others. Personal development is increasingly aligned with emotional intelligence, resilience and adaptability skills that are crucial in a rapidly changing global landscape (Côté, 2020). The rise of digital learning and self-directed online

resources has also expanded access to personal development tools, making it more customizable and inclusive (Meier, 2021).

Moreover, organizations and educational institutions are recognizing the role of personal development in fostering leadership, productivity and innovation. As such, personal development is now considered a strategic component of human resource development and lifelong learning policies (Organisation for Economic Co-operation and Development, 2023). Lifelong learning is central to personal development. As organizations face digital disruption and societal shifts, professionals must remain agile and proactive in upgrading their skills and competencies (Organisation for Economic Co-operation and Development, 2023).

Concept of Effective Communication

Effective communication is the process of exchanging information, ideas and emotions in a way that is clearly understood by all parties involved. It involves not only the transmission of a message but also its reception, interpretation and feedback, all of which are essential for mutual understanding and collaboration (Keyton, 2023). Communication underpins all professional interactions, affecting leadership, collaboration and performance. It is the exchange of information in a manner that ensures mutual understanding and action. It includes verbal, non-verbal, written and digital interactions (Keyton, 2023). Mastery of communication enhances collaboration, conflict resolution, leadership effectiveness and customer or client relations.

Effective communication is characterized by clarity, coherence, appropriate tone, active listening and responsiveness. It is context-dependent, shaped by cultural, social and relational dynamics (Gamble & Gamble, 2020). In today's increasingly digital and globalized environment, effective communication also requires digital literacy and

intercultural competence to ensure that meaning is accurately conveyed across different platforms and audiences (Chen et al., 2022).

Emotional intelligence is another crucial element in effective communication, enabling individuals to manage their own emotions and empathize with others during interactions (Goleman, 2022). In organizational settings, effective communication enhances teamwork, reduces conflict and improves performance outcomes (Robbins & Judge, 2023). Moreover, with the rise of hybrid and remote work environments, virtual communication skills, such as crafting clear written messages, managing video meetings and using collaborative tools have become increasingly vital for effective interpersonal and professional exchange (Klitmøller & Lauring, 2023). In hybrid and multicultural workspace, digital literacy and intercultural sensitivity have become essential components of communication competence (Chen et al., 2022). Furthermore, emotionally intelligent communicators can influence, persuade and inspire others more effectively.

Essential Skills for Professional Growth Through Leadership, Personal Development and Effective Communication

In the contemporary professional landscape, continuous growth is vital for career success and organizational contribution. Key among the drivers of such growth are leadership, personal development and effective communication. Mastery of essential skills in these areas enhances one's ability to navigate complex environments, inspire others and achieve strategic objectives. Here are some key skills required for professional growth through Leadership, Personal Development and Effective Communication

Leadership as a Driver of Professional Growth

Key leadership Skills include:

- **Emotional Intelligence (EI):** The ability to recognize, understand and manage one's emotions and those of others. High Emotional Intelligence fosters better decision-making and team dynamics (Goleman, 2021). Leaders who demonstrate emotional intelligence, inclusivity and adaptability are better equipped to navigate the complexities of the modern workplace (Goleman, 2022). These traits not only enhance one's capacity to lead but also improve interpersonal relations and workplace culture.
- **Strategic Thinking:** Leaders must envision the future and make decisions that align with long-term goals (Schoemaker et al., 2018).
- **Adaptability and Resilience:** Navigating uncertainty and bouncing back from setbacks are critical in dynamic work environments (Centre for Creative Leadership, 2023).
- **Influence and Negotiation:** Persuasive communication and effective negotiation help in aligning diverse interests and achieving common goals (Yukl & Gardner, 2020).

Practical Application

- Encourage mentorship and coaching relationships.
- Engage in leadership training that emphasizes ethical decision-making and emotional regulation.
- Participate in cross-functional team projects to develop collaborative leadership skills.

Personal Development as a Foundation for Growth

Key Personal Development Skills include**:**

- **Self-Awareness and Reflection:** Recognizing one's strengths, weaknesses, values and impact on others (Boyatzis et al., 2021).

- **Goal Setting and Time Management:** Setting SMART goals and managing time efficiently leads to productivity and clarity in personal growth (Locke & Latham, 2019).
- **Growth Mindset:** Embracing challenges and viewing failures as opportunities to learn promotes resilience and long-term success (Dweck, 2016).
- **Continuous Learning:** Staying updated with new knowledge, skills and trends is essential in a rapidly evolving work environment (Kolb, 2015).

Practical Application

- Set short- and long-term personal development goals.
- Use tools like self-assessment, feedback and reflection journals.
- Engage in continuous education through online courses and workshops.

Effective Communication: The Catalyst for Professional Impact

Key Effective Communication Skills include**:**

- **Active Listening:** Engaging fully with the speaker to understand their message, which builds trust and improves relationships (Brownell, 2020).
- **Clarity and Conciseness:** Expressing ideas clearly and directly enhances understanding and minimizes confusion (Guffey & Loewy, 2022).
- **Non-verbal Communication:** Understanding and utilizing body language, facial expressions and tone of voice can reinforce or undermine spoken words (Knapp et al., 2021).
- **Cross-Cultural Communication:** Awareness and respect for cultural differences in communication styles are crucial in diverse workplaces (Ting-Toomey & Dorjee, 2018).

Practical Application

- Practice active listening and empathetic responses.

- Improve public speaking and presentation skills.
- Utilize collaborative digital tools effectively in virtual communication.

Practical Recommendations

1. Structured Training Programs

- **Leadership Workshops**: Organize periodic training on strategic thinking, decision-making, team management and emotional intelligence.
- **Personal Development Courses**: Offer sessions on goal setting, time management, stress management and adaptability.
- **Communication Skills Training**: Provide practical training in active listening, public speaking, writing skills, feedback delivery and conflict resolution.

2. Mentorship and Peer Learning

- **Formal Mentorship Programs**: Pair junior staff with experienced professionals to provide guidance, share experiences and support leadership development.
- **Peer Coaching Circles**: Encourage small peer groups to meet regularly to discuss challenges, set goals and practice leadership and communication skills.
- **Leadership Shadowing**: Allow employees to observe senior leaders in action to learn effective communication, decision-making and team-building techniques.

3. Use of Technology and Tools

- **E-learning Platforms**: Provide access to leadership and communication courses through online platforms for flexible, on-demand learning.
- **Mobile Apps for Self-Reflection**: Encourage use of apps designed for journaling, goal tracking, or mood monitoring to promote ongoing self-awareness and development.

Conclusion

In conclusion, leadership, personal development and effective communication are not isolated skills but interconnected competencies that drive professional success. Professional growth is maximized when leadership, personal development and communication are integrated. For instance, an emotionally intelligent leader (leadership) who continually reflects and adapts (personal development) and communicates with empathy and clarity (communication) can build high-performing teams and foster a culture of excellence. Investing in these areas equips professionals to thrive in complex environments, lead with integrity and engage meaningfully with others. As the workforce continues to evolve, prioritizing these skills will remain critical for both individual and organizational advancement which forms the bedrock of professional growth. These skills are not static; they require deliberate practice, ongoing feedback and a commitment to lifelong learning. Organizations and individuals alike must invest in developing these essential skills to remain competitive and relevant.

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HARNESSING THE POTENTIALS OF BLENDED LEARNING IN EARLY CHILDHOOD EDUCATION: A PROFESSIONAL DEVELOPMENT PROGRAMME FOR TEACHERS IN THE NORTH CENTRAL NIGERIA

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Abstract

Blended learning involves the integration of face-to-face instruction with digital learning tools such as Learning Management Systems (LMS), video conferencing platforms, and mobile apps. Blended learning fosters active learning, supports diverse learning styles, and can enhance early childhood education by integrating technology into foundational learning. In Nigeria, blended learning approach has registered its presence, but the impact is yet to be harnessed. The transition of the world to digital media and information has increased the importance of ICT in education, and this will continue to grow in the 21st century. The Digital Research Centre, Universal Basic Education Commission, Nigeria, through key strategic planning, professional development, data-driven instruction, and the use of varied instructional and assessment methods recently introduced the blended learning approach in other to harness its potentials. The paper highlights technologies like interactive whiteboards and collaboration tools to enhance learning. It also discusses the potential of blended learning approach in improving children engagement, provide flexibility, and foster collaboration among teachers and children. However, challenges related to digital infrastructure and access were highlighted. This paper contributes to understanding of the applicability of blended learning in teaching literacy development in early childhood education, particularly in resource-constrained environments, emphasizing the importance of teacher training and harnessing strategic technology integration into early grade classrooms.

Keywords: Blended learning, early childhood education, professional development, digital tools, teacher training.

Introduction

Early childhood education (ECE) is essential for the comprehensive development of children, especially during their early years. In Nigeria, ECE includes a variety of educational initiatives tailored for children from birth to six years old, with the goal of promoting cognitive, emotional, social, and physical growth (Ogunleye, 2021). The global recognition of the importance of early childhood education is on the rise, as studies demonstrate that high-quality ECE significantly enhances children's preparedness for primary education, boosts their potential for lifelong learning, and supports their overall well-being. The execution of early childhood education programmes is shaped by multiple factors, including cultural, economic, and policy-related influences. Historically, ECE in Nigeria has encountered obstacles concerning accessibility, quality, and funding. Although the National Policy on Education acknowledges the significance of early childhood education and mandates its implementation (Federal Republic of Nigeria, 2013), a considerable number of children, especially in rural regions, still lack access to quality ECE services.

Reports suggest that only approximately 40% of children in Nigeria benefit from early childhood education, with notable disparities between urban and rural areas (UNICEF, 2020). Quality remains a critical issue within Nigeria's early childhood education sector. Numerous ECE programs are deficient in essential resources, qualified personnel, and well-structured curricula necessary for effective education. Consequently, children may not acquire the foundational skills required for their educational progression (Olaniyan, 2021). Additionally, teacher training and professional development are vital for ensuring quality ECE; however, many educators do not receive sufficient training in child-centered teaching methods or the incorporation of technology into educational settings (Akindele, Adeshola & Akinyemi, 2021).

In recent years, there has been a growing emphasis on innovative approaches to ECE, such as blended learning models, which combine traditional teaching methods with digital technologies. These approaches aim to enhance engagement and learning outcomes, especially in light of challenges posed by the COVID-19 pandemic, which disrupted educational systems worldwide (Afolabi, Ogunleye, & Iwajomo, 2021). Implementing blended learning in early childhood education presents a unique opportunity to bridge the gaps in access and quality, enabling educators to better support children's development in Nigeria.

The incorporation of technology into educational frameworks has significantly altered conventional teaching methodologies worldwide, with blended learning emerging as a notable advancement. This approach, which merges online digital resources with traditional classroom instruction, provides an opportunity to enhance educational delivery by utilizing both face-to-face and virtual learning experiences. The hybrid model has demonstrated potential in boosting student engagement, flexibility, and overall academic performance, especially in environments where the availability of teachers and resources is inconsistent (Hrastinski, 2019). Nevertheless, despite its widespread acceptance in higher education, the implementation of blended learning in early childhood education, particularly in developing areas such as North Central Nigeria, remains limited.

Early childhood education (ECE) serves as a crucial phase in the development of cognitive and social competencies, underscoring the importance of high-quality instruction in this field. The adoption of blended learning in ECE represents a forward-thinking initiative aimed at improving both teaching and learning experiences (Ng & Ng, 2021). In Nigeria, educators in early childhood settings frequently encounter obstacles, including insufficient professional development opportunities, lack of technological resources, and varying degrees of digital literacy among teachers (Ogunode, Jegede & Abubakar, 2020). These challenges can impede the successful implementation of blended learning models, which necessitate both technical skills and a transformation in teaching methodologies. There is a pressing need, therefore, for a comprehensive professional development program designed to assist educators in embracing blended learning practices. Such programs have long been acknowledged as essential for enhancing teacher effectiveness and improving classroom practices.

Blended learning

Blended learning represents an educational strategy that merges conventional in-person instruction with online or digital learning activities, creating a hybrid model that leverages the advantages of both methodologies (Graham. This approach provides flexibility in content delivery and fosters a personalized learning experience, accommodating the varied needs and learning preferences of students. Within a blended learning framework, students can interact with educational materials both in the classroom and through digital platforms independently, which can promote a deeper comprehension and allow for self-directed learning (Hrastinski, 2019). The implementation of this model can range from simple online enhancements of traditional lessons to more intricate systems where the majority of the learning takes place online, supplemented by occasional face-to-face interactions. Such flexibility not only enhances accessibility but also empowers educators to adopt more dynamic and engaging teaching methods (Halverson, 2017). Furthermore, it is recognized as an effective means to boost student engagement, as the incorporation of multimedia and interactive content renders the learning experience more engaging and pertinent to learners in the digital age.

Blended learning Models

Blended learning scenarios are influenced by various factors, including the educational environment, access to technology, and specific instructional objectives. Below are some comprehensive illustrations of prevalent blended learning models that combine traditional and digital methodologies, incorporating virtual learning, assignments, and assessments.

1. ***Rotation Model***

The rotation model consists of students moving between various learning stations, with some being face-to-face and others conducted online. For instance, in an early grade setting, children may rotate among a teacher-led station, an online station for personalized learning, and a collaborative group work station. The online components may include educational software or activities involving online research. Furthermore, virtual assignments and assessments can be utilized to gauge student performance across the different stations, enabling educators to customize learning experiences

(Horn & Staker, 2014). Students complete segments of their assignments online and participate in class discussions to expand on their digital work. While there are many different models of blended instruction, most lessons that are used in today's classrooms can be classified in one of three categories of the Rotation model:

- **Station Rotation:** Children rotate through stations in the classroom on a fixed schedule or at the teacher's discretion with at least one of the stations involving computer-based instruction.
- **Lab Rotation:** Similar to the station rotation model with the difference being that students transition to a different room for computer-based instruction, usually a computer lab.
- **Flipped Classroom:** In the flipped classroom approach, students engage with new material through digital resources prior to attending class, often utilizing videos or interactive modules. The classroom time is then dedicated to practical activities, discussions, or projects that enhance the understanding of the online content (Bergmann & Sams, 2012). For example, in a mathematics lesson, children may view a pre-record lesson at home that covers verbal reasoning, followed by in-class problem solving sessions where the teacher offers tailored assistant. The primary form of flipped instruction occurs outside of school while in-class time is spent working on engaging activities. Children access computer-based instructional resources on their own time, typically using their own devices. Virtual assignments, such as quizzes or practice exercises are completed online, and assessments can also be conducted virtually to monitor student progress and comprehension (Graham, 2013).
- **Individual Rotation:** The individual Station allows children to rotate through different learning modalities on a customized schedule, using the teacher's software created for each child. This type of rotation differs from other stations because learning is personalized and differentiated. Children can learn at their own pace.

2. Flex Model

In the flex model, the majority of instruction is delivered online, enabling students to access educational resources, virtual assignments, and assessments via digital platforms. While teachers are available for in-person support as required, the predominant mode of instruction remains virtual. For instance, in a basic science course, students may engage with online modules and undertake virtual assessments, such as quizzes or interactive simulations, complemented by occasional in-person laboratory sessions to enhance their understanding of theoretical concepts. This approach facilitates flexible pacing, allowing students to advance through virtual content at their own rhythm while attending class for focused assistance (Tucker, 2013).

3. ***Enriched Virtual Model***

The enriched virtual model integrates online learning with periodic in-person sessions. Students may attend class a limited number of times during the course for face-to-face interactions, while the majority of their learning and assessments are conducted online (Horn & Staker, 2014). For example, a university course might feature several in-person

seminars to present essential concepts, with students completing virtual assignments, participating in online discussions, and taking assessments through a learning management system. This model offers flexibility for students who are unable to attend in-person sessions regularly, while still allowing for valuable face-to-face engagement.

4. Project-based blended learning

In project-based blended learning, students engage in authentic projects that combine online exploration with in-person teamwork. For example, in a geography course, students may perform virtual investigations on climate change, engage in online simulations, and subsequently present their discoveries during class sessions. The virtual learning materials may encompass videos, simulations, and digital collaboration platforms, while assignments could require the online submission of research results or presentations. Evaluations within this framework can also be conducted virtually, utilizing tools such as e-portfolios or online presentations to monitor student development and project results (Halverson et al., 2017).

These blended learning environments demonstrate the effective integration of virtual learning, assignments, and assessments with traditional classroom instruction. By utilizing digital resources, educators can create a more engaging and adaptable educational experience that meets the diverse needs of learners.

Professional development is critical for equipping teachers to implement blended learning successfully. Educators must receive training not only in the use of digital tools but also in how to integrate these tools with conventional teaching methods to foster a unified learning experience (Graham, 2013). Opportunities such as workshops, online training sessions, and collaborative peer meetings can equip teachers with the essential knowledge and skills to design and oversee blended learning environments. Continuous professional development is vital to ensure that educators remain informed about the latest technologies and instructional methodologies. Blended learning offers a promising approach to professional development for early grade teachers, enhancing their instructional skills and knowledge. By combining online and face-to-face learning experience, teachers can engage in flexible, self-paced, and collaborative learning opportunities.

Harnessing the Benefits of Blended Learning for Early Grade Teachers

1. Personalized Learning: Teachers can learn at their own pace, reviewing content as needed.
2. Increased Flexibility: Online components can be completed at convenient times, reducing scheduling conflicts.
3. Access to Diverse Resources: Blended learning platforms can provide teachers with a wealth of resources, including videos, articles, and discussion forums.
4. Collaboration and Networking: Teachers can connect with peers and experts, sharing best practices and experiences.
5. Improved Student Outcomes: By enhancing teachers' instructional skills, blended learning can ultimately benefit early grade students.

Effective Strategies for Implementing Blended Learning:

1. Clear Goals and Objectives: Establish specific, measurable goals for teacher learning and student outcomes.

Teacher Support and Buy-In: Ensure teachers understand the benefits and are invested in the blended learning approach.
3. High-Quality Online Content: Develop or curate engaging, relevant, and interactive online resources.
4. Face-to-Face Components: Incorporate regular, structured face-to-face sessions for collaboration, feedback, and support.
5. Ongoing Evaluation and Feedback: Regularly assess teacher learning, student outcomes, and program effectiveness, making adjustments as needed.

Strategies for Implementing Blended Learning

The effective implementation of blended learning necessitates meticulous planning and a diverse array of strategies to facilitate the adaptation of both educators and learners to this hybrid educational model. Below are essential strategies for the successful execution of blended learning:

1. **Strategic Planning**

Strategic planning plays a vital role in crafting a blended learning environment that aligns with educational objectives and meets student requirements. This process involves identifying learning goals, selecting an appropriate mix of in-person and online activities, and ensuring that both elements enhance one another. Collaboration between administrators and educators is essential to develop a comprehensive plan that encompasses resource distribution, technology integration, and support for training (Tucker, 2013). Furthermore, this plan should address the necessary infrastructure for technology access, the support systems available for teachers, and the evaluation techniques to assess effectiveness.

2. **Data-Driven Instruction**

Data-driven instruction leverages student performance metrics to customize teaching strategies and learning activities. In a blended learning context, educators can collect data from online assessments, learning management systems (LMS), and various digital resources to track student progress in real-time (Halverson et al., 2017). This information aids in pinpointing students' strengths and weaknesses, allowing teachers to tailor learning experiences accordingly. By examining this data, educators can modify their instructional approaches to better address the unique needs of each student and enhance overall educational outcomes (Horn & Staker, 2014).

3. **Utilize Diverse Instructional Materials**

Employing a range of instructional materials enriches the educational experience by accommodating various learning preferences. Blended learning enables educators to merge conventional textbooks and lectures with digital resources such as videos, interactive simulations, and online readings (Bergmann & Sams, 2012). This combination of materials maintains student engagement and offers multiple avenues for comprehending the subject matter. Additionally, teachers can integrate multimedia resources to foster a more dynamic learning atmosphere, making abstract ideas more tangible and relatable.

4. **Leverage Technology to Enhance Learning**

Technology plays a pivotal role in blended learning and can be utilized to reinforce classroom instruction. Digital tools, including educational applications, interactive

whiteboards, and online quizzes, provide students with opportunities to practice skills and deepen their comprehension beyond the classroom setting (Graham, 2013). For instance, online platforms like Khan Academy or Google Classroom offer supplementary exercises and assessments that students can engage with at their own pace. These resources facilitate differentiated instruction, allowing students to revisit challenging concepts as necessary.

5. Experiment with Instructional Strategies

Blended learning provides educators with the opportunity to explore a range of instructional strategies, including the flipped classroom approach, project-based learning, and gamification. In the flipped classroom model, students engage with new material online prior to attending class, allowing in-person time to be dedicated to activities that reinforce or apply the acquired knowledge (Bergmann & Sams, 2012). Additionally, educators can integrate gamified components, such as badges or leaderboards, to enhance student motivation and engagement in the learning process. This flexibility in exploring diverse methods enables teachers to identify the most effective strategies tailored to their students' learning preferences.

6. Diversify Assessment Methods

Incorporating a variety of assessment methods is crucial in a blended learning context to effectively gauge student comprehension. Rather than depending exclusively on conventional examinations, educators can implement a combination of quizzes, peer evaluations, discussions, and digital portfolios (Hrastinski, 2019). Online platforms facilitate formative assessments through tools such as polls, interactive questions, or digital submissions that yield immediate feedback. This diverse approach ensures that students are evaluated through multiple avenues, providing a comprehensive reflection of their understanding and competencies.

7. Facilitate Digital Collaboration

Group collaboration is an essential aspect of blended learning, and digital tools play a significant role in enhancing teamwork among students. Platforms like Google Docs, Zoom, or Microsoft Teams allow students to collaborate on projects, share resources, and communicate effectively, irrespective of their physical locations (Tucker, 2013). These tools promote collaboration and teamwork, enabling students to complete group assignments online or beyond the classroom setting. Engaging in digital collaboration also helps students cultivate vital 21st-century skills, including digital literacy, effective communication, and teamwork.

Technologies for Implementing Blended Learning

The effective incorporation of suitable technologies is essential for the successful execution of blended learning. These technologies enrich the educational process, offering both flexibility and interactive experiences for educators and learners alike.
Below are several key tools frequently utilized to facilitate blended learning.

1. **Learning Management Systems (LMS)**

A Learning Management System (LMS) serves as a vital platform for the delivery and administration of both online and offline educational content. Platforms such as Blackboard, Canvas, and Google Classroom enable educators to create, distribute, and

monitor learning materials. Instructors can upload videos, assign tasks, and conduct assessments, while students can access resources and submit assignments through a unified portal. These systems enhance communication, assignment management, and performance analysis, positioning them as integral components of a blended learning environment (Osguthorpe & Graham, 2003).

2. **Video Conferencing Tools**

Video conferencing applications, such as Zoom, Microsoft Teams, and Google Meet, facilitate real-time interactions between educators and students. These tools allow for live virtual classes, promoting an interactive learning atmosphere where students can engage in discussions, pose questions, and participate in group activities from any location. Additionally, video conferencing tools offer features like screen sharing, breakout rooms, and live polls, which further enhance engagement in virtual learning settings (Hrastinski, 2019).

3. **Interactive Whiteboards**

Interactive whiteboards, such as SMART Boards and Promethean Boards, merge conventional classroom activities with digital interactivity. These devices enable educators to incorporate multimedia components, including videos and animations, directly into their instructional materials (Staker & Horn, 2012).

4. **Digital Assessment Instruments**

Platforms like Google Forms, Kahoot! and Socrative play a crucial role in evaluating student performance in real-time. Educators can utilize these tools to design and administer quizzes, gather feedback, and track progress, all while providing immediate results to learners. These digital instruments streamline the assessment process, enabling teachers to analyze data and adjust their instructional strategies based on student outcomes (Bonk & Graham, 2012).

5. **Collaboration Tools**

Collaboration is an essential aspect of blended learning, and digital resources such as Google Docs, Microsoft OneDrive, and Slack facilitate remote teamwork among students. These tools support real-time co-editing, file sharing, and team communication, promoting group work that extends beyond the physical classroom. Collaboration tools also foster the development of digital literacy and teamwork skills, which are vital for success in today's workforce (Staker & Horn, 2012).

Mobile Learning Tools

Mobile learning tools such as Coursera and Blackboard Mobile provide students with the flexibility to access learning materials on their smartphones and tablets. Mobile platforms enable students to engage in asynchronous learning by accessing course content, submitting assignments, and participating in discussions from any location, further enhancing the convenience and accessibility of blended learning (Means et al., 2013).

6. **Content Creation Tools**

Teachers and students can use content creation tools like Canva, Prezi, and Adobe Spark to develop visually engaging learning materials. These tools allow for the creation of infographics, presentations, and videos that can be used to complement in-class instruction or online learning. Content creation tools empower students to present

their understanding of a subject creatively and dynamically, making them an integral part of the blended learning model (Allen & Seaman, 2014).

Harnessing Teaching and Learning in Early Childhood Classrooms through Blended Learning Approaches

Blended learning, which integrates traditional face-to-face teaching with online educational components, has emerged as a revolutionary strategy in early childhood education. This model enhances both teaching and learning by incorporating diverse instructional techniques and utilizing technology to foster a more tailored and engaging educational experience. By facilitating a harmonious combination of in-person and virtual interactions, blended learning effectively addresses the varied needs of young learners and promotes a supportive learning atmosphere such as:

1. Increased Engagement and Motivation

A significant advantage of blended learning in early childhood settings is its capacity to boost engagement and motivation among young students. Interactive digital tools, including educational games, videos, and interactive storytelling, can captivate children's attention and promote active involvement in their educational journey (Ritzhaupt et al., 2015). For instance, the use of gamified learning platforms enables children to investigate concepts in an enjoyable and stimulating way, reinforcing their comprehension through play and exploration. This heightened engagement can result in increased motivation and enthusiasm for learning.

2. Customization of Learning Experiences

Blended learning facilitates the customization of educational experiences to cater to the individual needs of children. Educators can analyze data gathered from online activities to evaluate each child's progress and adjust their instruction accordingly (Picciano, 2017). For example, if a child encounters difficulties with a specific skill, educators can offer targeted online resources or activities that concentrate on that area, enabling differentiated instruction that accommodates various learning styles and paces. This tailored approach cultivates a more inclusive classroom environment, where each child's distinct strengths and challenges are recognized.

3. Development of Digital Literacy Skills

The incorporation of technology into early childhood education through blended learning equips children with vital digital literacy skills necessary for thriving in a digital environment. As children interact with diverse digital tools, they acquire the ability to navigate technology, assess information critically, and communicate effectively (Berk, 2016).

4. Facilitating Collaboration and Communication

Blended learning enhances collaboration and communication among children, educators, and families. Online platforms create opportunities for group activities and peer interactions, allowing children to work together on projects or share their work with classmates, irrespective of their physical locations (Graham, 2013). For example, children can employ digital tools to collaborate on a group presentation or participate in discussions on shared platforms.

5. Flexible Learning Environments

Blended learning encourages the establishment of flexible learning environments that can adjust to various contexts and schedules. This adaptability is especially advantageous in early childhood settings, where children's attention spans and learning preferences can differ significantly (Hwang & Chang, 2011). Educators can create learning experiences that blend in-person interactions with virtual elements, offering diverse opportunities that maintain children's engagement. For example, a teacher might present a concept in the classroom and subsequently assign an interactive online task that reinforces the lesson, allowing children to learn in a manner that aligns with their individual preferences.

Challenges of Assessing Digital Infrastructure in Using Blended Learning Approach

A significant challenge in the implementation of blended learning, especially in resource-limited regions such as North Central Nigeria, is the deficiency in digital infrastructure and restricted access to technology. Reliable internet connectivity is essential for effective blended learning. Unfortunately, in numerous rural and underserved locations, internet access is either non-existent or inconsistent, creating a considerable barrier to online education (World Bank, 2020). Even in urban settings, the prohibitive costs of internet data and frequent power interruptions further complicate matters, hindering both students and educators from fully engaging in blended learning initiatives (Afolabi et al., 2021). Additionally, the scarcity of adequate digital devices presents another challenge. A considerable number of students and teachers lack access to personal computers, tablets, or smartphones, which are crucial for participating in online learning. When devices are available, they are frequently outdated or insufficient for operating necessary educational applications (Suleiman, 2020). This digital challenges disproportionately impacts students from low-income households, resulting in disparities in educational access and engagement (Kira et al., 2021).

Furthermore, the lack of sufficient technological infrastructure within schools, such as the absence of operational computer labs or multimedia resources, further constrains the effectiveness of blended learning. Many educational institutions do not possess the means to invest in modern educational technologies, leaving them dependent on conventional teaching methods and diminishing the efficacy of blended learning approaches (Onyema et al., 2019). These challenges highlight the critical need to address infrastructural shortcomings and enhance access to digital resources to ensure the successful implementation of blended learning programs, particularly in areas with limited resources.

Conclusion

Nigeria is progressively adopting and enacting national ICT policy. In this competitive period of globalization, new methods of teaching and learning, with digital technologies have been identified to enhance and improve knowledge. Blended learning incorporates physical classroom sessions or in-person interactions with online resources and activities. The integration of technology into early childhood education through blended learning will equip children with vital digital literacy skills necessary for thriving in a digital environment. By embracing blended learning as a tool for

professional development, early grade teachers can enhance their instructional skills, leading to improved children outcomes and a more effective education system.

Recommendation

The factors suggested to be considered when implementing and choosing how to blend in-person and blended teaching and learning activities are:

1. Launch small-scale pilot programs to test and refine the blended learning approach.
2. The government should provide technologies for effective implementation of blended learning classroom for teachers, early years and primary school children.
3. Provide enabling environment (ICT-Driven) for effective teaching and learning in Nigeria ECE.
4. The management of early grade schools should make effort to provide children with access to internet networks in schools.
5. Management of Early Childhood Education should instill a maintenance culture to guarantee that the existing digital facilities and equipment are always in good condition
6. Provide comprehensive training and ongoing support for teachers to ensure successful implementation.
7. Ensure reliable, high-speed internet access and necessary devices for online learning components.
8. Communicate the benefits and goals of the blended learning program to administrators, parents, and the broader community.

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DIGITAL TECHNOLOGY USAGE FOR TRANSFORMING LEARNING EXPERIENCE IN EARLY CHILDHOOD CARE AND EDUCATION

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Abstract

Early Childhood Education is important to children growth and development. Globally, they cannot be any meaningful learning in Early Childhood Care and Education without incorporating digital technology that is appropriate to children age for effective teaching and learning. Therefore, there are new trends and innovations in the field of early childhood education that childhood educators/student needs to be acquainted with to be able to handle children effectively in this 21st century. Digital technology is one of the innovations that aid children educational development and incorporating it in early childhood education classroom will encourage active learning, knowledge construction inquiry and exploration among children when applied correctly. Therefore, this paper looked at the definition of digital technology, types of digital technology accessible for children in Early Childhood education classroom, important connectivism element for early childhood care and education, advantages and disadvantages of integrating digital technology in early years. Finally, conclusion and recommendations were made.

Keywords: Digital Technology, Learning Experiences, Early Childhood Care and Education

Introduction

The application of digital technology in Early Childhood Education has refashioned the entire educational structure and has increased children's learning. Utilizing digital tools in early childhood education is not only what is trending but a vital resource that can enhance the learning experience and academic performance of children when applied carefully (Khan, 2016). Mishra (2017) asserted that children are developing in a technologically advanced environment and are getting used to it very fast. In view of the foregoing, education stakeholders have been looking for ways to leverage digital technology to engage and effectively educate these tech-savvy children on how to use it to enhance their educational growth and development.

In the past, early childhood educators taught children in the conventional classrooms with textbooks, and also had face to face interactions with children in the teaching-learning process. Currently, with the introduction of technology in education, the concept of a classroom has surpassed its physical limits. Virtual learning platforms, online materials, and interactive tools have changed how children learn (Mohammed, 2020). Today children can study in any location and time (Mohammed, 2021).

However, in this technology age, where devices play a significant role in teaching and learning in early childhood education, the question now is, how are these tools impacting children. This question goes beyond simply recognizing these devices; it also focuses on understanding how these devices are used to enhance children learning outcomes especially, when used correctly. The integration of technology in the classroom do not only supports children's development, it also provides early childhood educators and caregivers with the opportunity to use and access modern, innovative

teaching strategies that enriches both visual and auditory experiences (Abdullahi and Adebayo, 2019).

Children grasp information more quickly when all the senses are engaged. Consequently, early childhood educators should adopt technology in their classrooms, because it fosters collaboration, teamwork, and enriching learning experiences for both children and adults (Khan,2016). Furthermore, it aids in the development and improvement of children's academic and social abilities, while also enabling them to use modern digital devices that are prevalent in today's society (Ogbonnanya, 2017).

Conceptual Clarifications

Digital Technology is the use of electronic tools and systems to create, store, process, and share information in Early Childhood Care and Education. This include various technologies, including software, hardware, and internet-related tools. Adalikwu and Dibal (2018) define Digital technology as electronic instruments, systems, devices, and resources that use binary code (0 and 1) to process or generate data. This technology is regarded as the foundation of contemporary communication and computing systems. It serves as the foundations that describe how the modern world operates and interacts with digital tools. Many facets of human life have been profoundly altered by the use of information and communication technology (ICT) particularly in the areas of teaching and learning (Leiner,2015).

Presently, children are exposed to technology through various activities namely; gaming, playing both at school, home and in external environments (Ogbonnanya and Okeke, 2020). Regretfully, a large number of Nigerian educators, especially those working with children, are not adequately digitally literate (Yusuf and Uche, 2022). It is very important that these elements be integrated into Nigerian children's family,

school, and community settings in order to guarantee their success in a world that is becoming more and more influenced by digital technologies, which are crucial in the twenty-first century. A fundamental component of teacher preparation programs and early childhood curricula should involve digital learning to improve children performance in the classroom (Kadiri, 2021).

Early childhood education is the education offered to children from birth to the age of five. The Nigerian Educational Research and Development Council (NERDC,2008) defines early childhood education or care as the first stage of structured learning, aimed primarily at familiarizing little children with a school setting. This stage serves as a transition between the home environment and a school-based context. The Federal Republic of Nigeria, in its National Policy on Education (FRN, 2014), describes it as the educational experience provided to children in an institution before they start primary school. At this stage, children are considered digital natives. Yusuf and Uche, (2022) argued that children born into a digital era where terms like web, podcast, and Google are commonplace require significant engagement in their educational experiences to thrive and succeed. They engage in reading, writing, and thinking in digital formats. Therefore, the integration of digital technology within the classroom is essential to enhance children academic achievement. For example, having digital technology laboratory is crucial in all early childhood classrooms in line with the Reggio Emilia approach.

Examples of innovative digital technology for early childhood Education classroom include; Computers, smartphones, smart TVs, Online games, video on demand websites, traffic lights and pedestrian crossings, automatic doors and cloud platforms, such as Microsoft 365 or Google Docs. Aside the above mentioned digital technology, there other ICT tools such as radio, MP3, CD, DVD, interactive white board, projectors

among others. Incorporating these technologies into early childhood education effectively may enhance ICT skills because children engage with technology during play and significant learning experiences (Abdullahi and Adebayo, 2019). It also presents new opportunities to enhance various elements of early childhood education practices, such as communication, collaboration, creativity, socio-dramatic play, and the ability to learn how to learn. Today, integrating technology is one of the most prominent trends in early childhood education, and the advantages of including it in an Early Childhood Care and Education (ECCE) classroom are substantial (Yusuf, 2023). This paper utilizes connectivism theory to examine how digital technologies, interactive tools and digital resources are used to support active, hands-on, and collaborative learning experiences in early childhood education that are crucial to the teaching-learning process. Connectivism suggests that knowledge is distributed across networks, and learning occurs through the connections that are made within networks. It also stresses on the role of technology and digital tools in connecting learners with sources of information and share such information with each other (Chen and Kuo, 2020). In the context of early childhood education, connectivism has significant implications on how technology can be integrated into teaching and learning processes. The paper therefore centres on digital technology as a veritable tool for transforming learning experience in Early Childhood Care and Education.

Connectivism Elements for Early Childhood Education Classroom:

The following are connectivism elements for early childhood education classroom

1. **Learning through Networks**: children can benefit from learning in interconnected environments, where they engage with teachers, peers, and digital tools. These networks help them build knowledge and skills collaboratively.

2. **Technology as a Mediator**: Introducing technology like tablets, interactive apps, or educational websites in early childhood education can support children's learning by providing access to various information and experiences. For example, apps that help children explore colors, shapes, or even Math concepts allow them to make connections across various domains of knowledge.

3. **Collaborative Learning**: Connectivism focused on the value of interaction and communication in learning. Early childhood educators are encouraged to use digital tools that allow collaboration among students, either in a classroom or virtually. For example, digital storytelling apps enables children work together in creating stories thereby fostering a collaborative approach to learning.

Advantages of Integrating Digital Technology in Early Childhood Education

The followings are various ways that digital Technology can contribute to, or transform, the activities, roles, and relationships experienced by children in early childhood education environment (Khan, 2016). It helps children to engage with computers to play games, listen to stories, or create drawings, it helps children to utilize ICT tools during games or role-play activities, it enables them access the Internet to find information or resources prompted by their curiosity about a specific topic or idea, it helps children to capturing digital photos, videos, or audio recordings of activities within the early childhood education setting and reviewing them together, or sharing them with parents, it helps child educators and children to employ ICT to compile portfolios that showcase children's work, which can be used to assess their learning and development progress, it also help child educators use videoconferencing, online discussion forums, or email to connect with other educators, parents, or researchers, or to exchange news and updates about happenings in the early childhood education center (Nematullah, 2018).

Disadvantages of Integrating Digital Technology in Early Childhood Education

Children may experience negative physical effects due to excessive screen time, which can result in decreased physical activity, disrupted sleep patterns, and challenges in social interactions. Children can as well be exposed to harmful and inappropriate content – with a vast amount of information available online; it can be challenging to supervise what children might encounter. Emerging digital technologies are enhancing learning opportunities for children while introducing new risks and concerns for parents and educators about the potential harm they may cause. It has also been revealed by several authors that excessive use can sometimes result in developmental delays (Adalikwu and Dibal, 2018). Despite these fears, child educators in several studies asserted that careful, comprehensive, and knowledgeable integration of ICT throughout the curriculum is the optimal solution to many of these issues (Shittu, Kamal, Abdulrahman and Ahmad, 2011). Research has shown that numerous risks can be mitigated through the sophisticated integration of technology in early childhood education (Ogbonnanya, 2017).

Conclusion

The use of technology in early childhood education is more than just a passing trend; it is a transformative instrument that, when utilized thoughtfully, can enrich the learning journey. The key is to strike an appropriate balance, guarantee accessibility, and always acknowledge that technology is meant to complement rather than substitute the personal touch in education. Let us welcome this digital age with an open mind and a dedicated spirit, ensuring that our youngest learners benefit from the best of both realms (Kadiri, 2021) Technology has undoubtedly revolutionized early childhood education. When applied mindfully and judiciously, it can amplify learning opportunities, captivate young intellects, and equip children for the digital landscape they will face as they

mature (Khan, 2016). Nonetheless, it is crucial to stay attentive to possible downsides and emphasize a balanced approach that involves both technological and traditional educational methods. By adopting this approach, educators and students in early childhood care and education can fully leverage technology's potential to provide children with a comprehensive, engaging, and effective learning experience.

Recommendations

The following recommendations were made to facilitate the integration and use of Digital Technology in Early Childhood Care and Education.

1. The government should provide funds for the purchase of digital facilities to schools in Nigeria. They should also fund smart school library programs sufficiently to allow for adequate professional and support staff.
2. Seminar and workshop on technological innovations should be organized from time to time for early childhood care educators/care givers to keep them abreast with current trends as well as empower them with the appropriate technological skills required for the correct use of emerging digital technology; and
3. There should be an improvement in the supply of electricity in the country by the Government. Where this is not achievable, school management should provide an alternative means of power to avoid power interruption and its resultant consequences on the use of digital technologies in early Childhood Educator e.g. the provision of solar panels and inverter as alternative source of power.
4. Child Educators/Care-givers should be encouraged to use innovative technologies that are appropriate to children age in the classroom for effective teaching and learning.

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CHEMISTRY TEACHERS' AWARENESS AND ATTITUDE TOWARD THE USE OF INNOVATIVE STRATEGIES IN SECONDARY SCHOOLS IN ABIA STATE

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Abstract
This study was a descriptive survey research conducted to investigate chemistry teachers' awareness and attitude to innovative teaching strategies in secondary school in Abia State. The population consisted of three hundred (300) teachers from fifty secondary (50) schools in four educational zones in Abia State. Using random sampling technique, one hundred and fifty (150) chemistry teachers were selected for the study. Four research questions and two null hypotheses guided the study. The instrument for data collection was a structured questionnaire developed by the researcher titled "Teachers Awareness and Attitude towards Innovative Teaching Strategies (TAAITS). The instrument was validated by three experts in chemistry education. Reliability of the instrument was established using Spearman Brown correlation coefficient, which gave a reliability index of 0.74 for level of awareness and 0.69 for attitude scale respectively. Mean and standard deviation were used in answering the research questions and z-test for null hypotheses tested at 0.05 level of significance. The findings of the study revealed among others that, chemistry teachers are aware of the existence of innovative teaching strategies and their attitude toward their utilization is positive. Gender had no influence on Chemistry teachers' awareness and attitude toward innovative strategies. The study thereafter recommended among others, that instructional packages should be designed and developed to stimulate teachers' innovative and creativity skills to incorporate innovative teaching strategies in chemistry teaching and learning.

Keywords: Chemistry education, awareness, attitude, innovation, strategy

Introduction

In Nigeria, the teaching of chemistry leaves much to be desired as Chemistry teachers carry out their duties in such a way that the subject appears very abstract and unrealistic to the students. Teachers are usually under intense pressure to cover the curriculum and get the students ready for external examinations. The teaching of chemistry at secondary schools needs to be totally overhauled and refocused if progress is to be made in science and technology education for wealth creation and sustainable national development. It should be noted that methods of instruction have profound influence on the ease with which learners tackle the tasks before them. The teaching strategies and methods used by the teacher affect the level of difficulty experienced by the student in the learning task. If learners are taught in a way that enables them find value in the content being taught, in terms of applicability of the acquired experiences to the solution of their daily real-life problems they would learn easily (Ogunode, Okwelogu & Ahaotu 2021).

When learning tasks are planned in such a manner as to enable students solve personal and societal problems, they would indicate high level of motivation and interest, and learning would become engaging, easy and less boring. Thus, the teaching strategy adopted by teachers have decisive impart on learners' attitude and achievement in the learning process (Njoku 2019).

This paper addresses the awareness and attitude of chemistry teachers on innovative strategies used in science teaching and learning with particular reference to chemistry as subject taught at senior secondary education. Nigeria's education system encompasses three different sectors of education namely basic education, post-basic/senior secondary education, and tertiary education (Ogunode, Okwelogu & Ahaotu 2021).

Being an effective class teacher involves implementing effective teaching strategies for the learning process. The classroom is a dynamic environment that bring together learners from different backgrounds with various abilities and personalities. To be an effective teacher therefore, requires the implementation of creative and innovative teaching strategies to meet learners' individual needs. Whether a teacher has been teaching for one year or twenty years, it can be difficult to determine which teaching strategies will work best with a group of learners. As a teacher, there is no 'one-size-fits-it-all' solution, so there is a range of innovative effective teaching strategies a resourceful teacher can use in the classroom. As stated by Sintema (2020) there are five essential elements for the successful incorporation of innovative learning strategies which include individual and group accountability, positive interdependence, promotion of interaction, teaching learners the required interpersonal and small group skills and group processing. Learners taught via innovative strategies achieve more, reason better, gain higher self-esteem, love learning tasks more and have better team spirit (Eze 2019; Sintema 2020; Aminu 2023).

The integration of innovative strategies into education presents a promising avenue to revitalize science teaching. Science pedagogy offers innovative methods for teaching and learning, making science process skill acquisition more engaging and accessible. In the context of Chemistry education in secondary schools, innovative strategies can bridge the gap between traditional teaching methods and contemporary learning preferences. Innovation is the strategy of designing through excellent teaching methods, practices, techniques and technology to improve learning (Godiya 2020; Mafara & Shehu 2023). The incorporation of innovative strategies will transform educational experiences for learners. Many innovative teaching strategies have been identified which includes active learning problem sheets method, just-in-time teaching,

interactive lesson demonstration, blended learning approach, digital strategy, project-based learning, peer-led team learning, flipped learning, demonstration method and many more (Mikautadze, Gondauri & Batiashvili 2020; Igbanugo 2024).

Apata (2017) in a study conducted to assess Physics teachers' awareness and attitude to innovative teaching strategies in senior secondary schools in Kwara State revealed that Physics teachers are aware of the existence of innovative teaching strategies. Their attitude to the strategies was positive. Also, gender had no influence on awareness of innovative teaching strategies but female teachers had positive attitude toward innovative teaching strategies compared to their male counterparts.

Usak, Eboka and Uzoechi (2020) in a study blamed the poor achievement in chemistry on wrong teaching strategies adopted by chemistry teachers over the years. Chemistry as a subject is not only abstract but volatile and requires to be taught using varieties of teaching strategies so as to ensure that learners have a good understanding of the concepts. According to Wagbara (2020) the use of one teaching method makes teaching boring and uninteresting to students. Science education programmes must focus attention on innovative teaching strategies that can promote creative/critical thinking in scientific problem-solving. There is need for a shift from the teacher centered approach to learner-centered methods that engage students actively in the learning process.

Strategy is the same as pedagogy which refers to methodologies of teaching. It can also be described as the very act of teaching. The strategy adopted by teachers shapes their actions, judgments and feed backs. One of the factors responsible for poor students' achievement in chemistry is poor teaching strategy adopted by the teacher. Improper selection of teaching strategy will influence learners understanding of the subject and application of knowledge to outside environment. Although there is no single method of teaching, but the conventional strategy of talk-chalk-method which is

teacher centered have been reported to result to non-participation of learners. There is need for teacher to embrace pedagogical change through innovative teaching strategies, to enhance students' performance. Effective teaching is not a set of generic practices, instead is a set of context-driven decisions about teaching. Teachers should not use the same set of practices for every lesson. The use of innovative strategies will stimulate students' interest, enhance their participation, promotes creativity, curiosity and reduces boredom in the classroom giving room for continuity even at home. Therefore, as part of assessment study towards the introduction of innovative teaching strategies, it is imperative to ascertain the chemistry teachers' level of awareness and attitude toward innovative teaching strategies in Abia State which is the main objective of this study.

Purpose of the study

As specific objectives, the study was designed to ascertain the,

1) Level of awareness of Chemistry teachers on 21st century innovative strategies for teaching Chemistry.
2) Attitude of Chemistry teachers to the use of 21st century innovative strategies for teaching Chemistry.
3) Influence of gender on the level of teachers' awareness to 21st century innovative strategies for teaching Chemistry.
4) Influence of gender on teachers' attitude toward the use of the 21st century innovative strategies for teaching Chemistry.

Research questions

1) What is the level of awareness of secondary school teachers in Abia State of 21st century innovative strategies for teaching Chemistry?
2) What is the attitude of secondary school teachers in Abia State toward the 21st century innovative strategies for teaching Chemistry.
3) Is there any gender difference in teachers' level of awareness to the 21st century innovative strategies in teaching Chemistry.

4) Is there any gender difference in teachers' attitude toward the 21st century innovative strategies in teaching Chemistry.

Hypotheses

Two null hypotheses were used to provide answers at significance level of 0.05,

HO_1: There is no significant difference in the mean awareness scores of male and female chemistry teachers on the 21st century innovative strategies for teaching Chemistry.

HO_2: There is no statistically significant difference in the mean attitude rating of male and female chemistry teachers toward the 21st century innovative strategies for teaching Chemistry.

Methodology

A descriptive survey research design was used for the study. This study was carried out in Abia State. The population covered all chemistry teachers totaling three hundred (300) in four educational zones. Using purposive sampling technique, fifty (50) schools that met the criteria were selected. The selection was based on schools that had a full-time chemistry teacher(s), must have presented students for Senior School Certificate Examination (SSCE) for four years. Finally using simple random sampling technique eighty (80) male and seventy (70) female chemistry teachers formed the sample groups for the study.

The instrument for data collection was structured questionnaire adopted on a 4-point Likert type scale which was weighted as follows: Strongly agreed (SA) =4, Agree (A) =3, Disagree (D) =2, Strongly disagree (SD) =1. The questionnaire was developed by the researchers and tilted "Teachers' Awareness and Attitude towards Innovative Teaching Strategies (TAAITS)". The questionnaire had two sections. Section one consisted of seven (7) items that sought information on level of awareness, while section two comprised of seven (7) items on the attitude of chemistry teachers' toward 21st century innovative strategies for chemistry teaching. The Instrument was validated

for face and content reliability by two science educators and one specialist in measurement and evaluation from Imo State University Owerri. The comments and suggestions of the experts were incorporated in building up the final draft of the instrument. The instrument was trial tested on forty (40) chemistry teachers from five (5) secondary schools in FCT Abuja. The results were used to determine the reliability of the instrument using Spearman Brown correlation coefficient, which gave a reliability index of 0.74 for level of awareness and 0.69 for attitude scale respectively. These values were considered reasonably high, hence indicating that the questionnaire was adequate and reliable for the study. The developed questionnaire was administered and collected from respondents with 100% retrieval via face-to-face method at 2023/2024 STAN chemistry panel workshop. Data collected were analyzed in line with the research questions formulated to guide the study. Mean and standard deviation were used to provide answers to the research questions. The criterion mean value of 2.50 and above were regarded as acceptance or agreement while, those with mean values less than 2.50 were regarded as rejection or disagreement. The null hypotheses were tested using Z-test at 0.05 statistical level of significance.

Results and Discussion

Research question one: What is the level of awareness of secondary school teachers in Abia State of 21st century innovative strategies for teaching Chemistry?

Table 1: Teachers' awareness of innovative strategies for teaching Chemistry

S/N	Item Statements	Male Teachers			Female Teachers		
		Mean	SD	Decision	Mean	SD	Decision
1	Am aware that activity-based teaching is student centered, involve collaborative learning, active participation and real-world connection.	3.66	1.53	Agree	3.71	1.64	Agree
2	Am aware that project-based learning can foster 21st century skills like peer networking and communication in students.	3.00	1.46	Agree	3.27	1.65	Agree
3	Am aware that peer-led team learning is a strategy in which students use variety of learning activities to improve their understanding of a subject.	3.90	1.63	Agree	3.51	1.79	Agree
4	Interactive approach can transform the teacher centered method to learner centered.	3.41	1.76	Agree	3.94	1.76	Agree
5	Am aware that peer instruction will foster students' interaction and refocus their attention on the subject matter.	3.66	1.83	Agree	3.70	1.60	Agree
6	Innovative strategies engage students effectively, makes learning more interactive and meaningful.	3.82	1.09	Agree	3.77	1.35	Agree
7	Am aware that innovative strategies could reinforce feedback loop.	3.30	1.10	Agree	3.49	1.30	Agree
	Average mean	**3.54**			**3.63**		

From Table one above, all the items had mean responses above 2.50 and so were accepted as evidence that chemistry teachers in Abia State were aware of the existence of innovative strategies used in teaching chemistry to 21st century students.

Research question two: What is the attitude of secondary school teachers in Abia State toward the 21st century innovative strategies for teaching Chemistry?

Table 2: Teachers' response on attitude towards innovative strategies in teaching chemistry

		Male Teachers			Female Teachers		
S/N	**Item Statements**	**Mean**	**SD**	**Decision**	**Mean**	**SD**	**Decision**
1	I effectively use Innovative strategies in teaching chemistry.	3.90	1.72	Agree	3.74	1.66	Agree
2	I use innovative strategies notwithstanding the challenges involved.	2.70	1.64	Agree	2.90	1.20	Agree
3	I feel innovative strategies will increase learners' interest in chemistry.	3.30	1.50	Agree	3.55	1.70	Agree
4	Am ready to learn more about innovative strategies to improve students' performance in chemistry.	3.20	1.66	Agree	3.31	1.09	Agree
5	Use of innovative strategies is difficult and time wasting.	1.50	0.44	Disagree	1.20	0.40	Disagree
6	To prepare lesson using innovative strategies increases achievement of stated objectives.	3.60	1.78	Agree	3.60	1.78	Agree
7	I organize chemistry practical using collaborative, demonstration and interactive strategies.	3.40	1.56	Agree	3.10	1.04	Agree
	Average mean	**3.09**			**3.06**		

From Table two above, all the items had mean responses above 2.50 and so were accepted by chemistry teachers in Abia State, showing positive attitude toward

innovative strategies used in teaching chemistry to 21st century students. However, item five recorded mean value below 2.50 hence revealed disagreement.

Research questions Three: Is there any gender difference in teachers' level of awareness to the 21st century innovative strategies in teaching Chemistry.

Table 3: Overall mean and standard deviation of male and female chemistry teachers' awareness toward the 21st century innovative strategies in teaching chemistry

Gender	N	Mean	SD	Mean Difference
Male	80	3.54	1.44	0.14
Female	70	3.63	1.58	

From the result in Table 3, the mean score of male chemistry teachers on level of awareness to innovative teaching strategies was 3.54 with standard deviation of 1.44 while the female counterparts had mean value of 3.63 with standard deviation of 1.58. This resulted in mean awareness difference of 0.14 indicating equality.

Research questions Four: Is there any gender difference in teachers' attitude toward the 21st century innovative strategies in teaching Chemistry.

Table 4: Overall mean and standard deviation of male and female chemistry teachers' attitude toward the 21st century innovative strategies in teaching chemistry

Gender	N	Mean	SD	Mean Difference
Male	80	3.09	1.47	0.03
Female	70	3.06	1.27	

The results in Table four revealed that, male teachers had mean attitude rating of 3.09 toward innovative teaching strategy and standard deviation of 1.47. Female teachers had mean attitude rating of 3.06 with standard deviation of 1.27 resulting to mean attitude difference of 0.03 indicating positive attitude with no disparity between male and female teachers.

Hypotheses Testing

HO1: There is no significant difference in the mean awareness scores of male and female chemistry teachers on the 21st century innovative strategies for teaching Chemistry.

Table 5: Z-test analysis of male and female chemistry teachers' awareness of innovative teaching strategies.

Source of variation	N	Mean	SD	Df	Z-calculated	Z-critical	P<0.05
Male	80	3.54	1.44	148	0.41	1.96	Not Significant
Female	70	3.63	1.58				

From Table 5 the Z-calculated value of 0.41 is less than Z-critical value of 1.96, hence, the null hypothesis is accepted at 0.05 significance level and 148 degree of freedom that, there is no significant difference between the mean scores of male and female chemistry teachers on their level of awareness to the 21st century innovative strategies for teaching Chemistry.

HO2: There is no statistically significant difference for mean attitude rating of male and female chemistry teachers toward the 21st century innovative strategies for teaching Chemistry.

Table 6: Z-test analysis of male and female chemistry teachers' attitude toward innovative teaching strategies

Source of variation	N	Mean	SD	Df	Z-calculated	Z-critical	P<0.05
Male	80	3.09	1.47	148	0.34	1.96	Not Significant
Female	70	3.06	1.27				

From Table 6 the Z-calculated value of 0.34 is less than Z-critical value of 1.96, therefore, the null hypothesis is accepted that there is no significant difference between

the mean scores of male and female chemistry teachers on their attitude toward the 21st century innovative strategies for teaching Chemistry.

The results of this study from Table 1 revealed that chemistry teachers in Abia state have high-level of awareness on the existence of innovative strategies used in teaching chemistry. This implies that chemistry teachers were exposed to these innovative teaching strategies during training and this is commendable since it will improve their method of teaching to become more of learner centered. In addition, teachers have realized the importance of innovative strategies in motivating and engaging students for better learning. This is related to Amadi (2021) findings, who reported that in cooperation of innovative teaching strategies by science teachers enhanced students' achievement. Also, Apata (2017) in his study on Physics teachers' awareness of innovative indicated that Physics teachers are aware of the existence of innovative strategies, which he attributed to the era of mobile technology where information can be sourced through internet at any time. Part of the finding as shown in Table 2 is that Chemistry teachers exhibited positive attitude toward innovative strategies. The persistent poor performance of students in external examination had left teachers with no other choice than to migrate from the teacher centered methods to students centered that will enable learner become active participants in the learning process. This finding is in agreement with that of Agu (2023) who reported that teachers had positive attitude toward the use of innovative strategies in teaching and learning of abstract concepts in science.

The study also revealed from Table 5 and 6 that there is no significant difference between male and female teachers in awareness and attitude toward innovative teaching strategies. This is in agreement with Isah, Olorukooba and Usman (2013); Apata (2017) whose findings reported no significant difference between male and female in terms of

utilization and attitude toward pedagogical skills used in teaching of Chemistry. They observed that gender had no influence on attitude toward innovative strategies, both male and female teachers participated equally in the use of new teaching strategies.

Conclusion

From the findings of this study, the following conclusions were made. That chemistry teachers have high level of awareness on 21st century innovative strategies used in chemistry teaching and learning. Also, the attitude of teachers toward the innovative strategies used in chemistry teaching and learning was positive. Furthermore, there is no gender disparity toward these innovative strategies. That is, gender has no significant influence in the level of awareness and attitude of teachers on innovative teaching strategies.

Recommendations

Based on the findings and conclusion of this study the following recommendations were made;

i. Chemistry education curriculum planners should incorporate topics in innovative teaching strategies, to enhance innovative skills of teachers.
ii. Instructional packages should be designed and developed to stimulate teachers' innovative and creativity skills in chemistry teaching.
iii. Chemistry teachers should include innovative strategies in teaching of chemistry as to promote higher academic achievement of their students in external examinations.
iv. Professional bodies like STAN should organize workshop, seminar and conferences for teachers to update their knowledge in the area of modern innovative strategies for 21st science teaching and learning.

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CURRICULUM INNOVATION FOR STUDENTS WITH SPECIAL NEEDS IN SECONDARY SCHOOLS IN NIGERIA

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Abstract
This paper discuss ed curriculum innovation for students with special needs in Nigeria. In doing this, it looked into what curriculum is all about, also delved into explaining what innovation of the curriculum is. The paper equally x-rayed the concept of special needs education, detailing whom it is meant for and what the objectives entail as stated in the National Policy on Education of Nigeria. It addressed the importance of curriculum innovation for students with special needs and listed the principles guiding the innovation of a given curriculum. In addition the paper examined the challenges facing the innovation of the curriculum for students with special needs in Nigeria, and proffered some suggestions for tackling such challenges among which is that the government should increase the funding of education in general and special needs education in particular. Based on the discussions conclusion was drawn.

Keywords: curriculum, special needs, innovation, inclusion

Introduction

In Nigeria, the educational sector has experienced some evidential improvement in reforms over the years. However, the system is still not fully developed. There are many children of school age that cannot access adequate education suitable to them. These children are those living with special educational needs. The Federal Republic of Nigeria on her National Policy on Education (2013), stated that special education is a formal education given to children and adults with special needs. This therefore affirms that people with special needs also has education as a fundamental human right. The education system in the country seems restrictive in terms of curriculum, environment, facilities and pedagogy to this category of learners and therefore requires great deal of modifications in order to actualize their potentials.

Though the Nigerian government has acknowledged and are involved in carrying out special needs education, initiated and introduced different policies and acts into it, there yet are a lot of inconsistencies in terms of implementation. This leads to students in this category not actualizing their potentials in life academically, socially, vocationally, emotionally, economically and even mentally. However, students with special needs should have rights just as other ones without special needs more especially with regards to adequate education. This view was reiterated by Dickson (2013) who stated that students with intellectual disabilities have the same rights as students without disabilities, and in particular a right to suitable educational services. In order to implement this very important right, it is necessary to develop suitable curriculum, varied teaching interventions with skills and assessment instruments that will meet the various needs of the students with special needs

Curriculum

The curriculum is all of the planned learning experience, not just the subject syllabus, intended for children and youths which they receive through going to school. Onwuka in Udom (2013) noted that curriculum is a structured series of intended learning, involving purposeful experiences provided and directed by school or educational institutions to achieve predetermined goals. Ogunyemi (2009), in his own contribution viewed curriculum to mean the planned and unplanned experiences which learners receive in the process of their formal or semi-formal education for the purpose of becoming rounded persons who can make useful contributions to the betterment of their society and world. It is what a nation sets out as her ambitions for the future of her peoples' development. According to Karkkainen (2014), Curriculum holds an outstanding place when seeking to promote innovation in education, as it reflects the vision for education by indicating knowledge, skills, and values to be taught to students. It may express not only what should be taught to students, but also how the students should be taught. It is worthy of note that the aims and objectives of a nation's education will not be effectively actualised when the curriculum is not in tandem with what is obtainable in the society or its postulations. Syamsuar and Reflianto (2019) in Ira, Darul, Ali, Beni & Weni (2023) stated that education and learning will not be achieved optimally if the curriculum is not relevant to demands of times. Therefore as the times change, the curriculum equally needs to be modified or innovated to meet the needs of individuals and that of the society.

Curriculum Innovation

Curriculum innovation thus, is all about bringing the solution to the quest of the constant changes in the society thereby changing the educational contents and processes to prepare the students for current and future realities of the world they operate in. Such

innovation means the process of changing or updating the curriculum content by utilizing new methods or strategies, new technological facilities, more especially in this 21st century realities. The curriculum should therefore, be made to inculcate functional skills, self management, teamwork, self-directed problem solving skills, effective involvement, creative thought process and entrepreneurial skills. Curriculum innovation aims to bring more effective learning approaches, prepare students to face the future challenges and create a more interesting and meaningful learning environment (Lualiya, Zadal & Sahariani 2022 in Ira et al 2023).

If there are innovations in other world systems such in businesses, constructions, even in government processes, by applying new strategies, updating products and services, there is therefore the need for innovations in the educational curriculum for students with special needs. With the advancement in the technology world of the 21st century such as the assistive technology, information and communication technology and artificial intelligence, it is pertinent that the education for students with special needs will follow the same way. Technology is a vital instrument that aid teaching and learning generally and particularly for those that have some challenges such as those with special needs. One area of difficulty that students with disabilities face regularly is navigating a curriculum that is not built to suit their learning needs. This could be due to the context or environment the user is in, the tools available such as assistive technologies such as Braille devices, voice recognition systems, or alternative keyboards and the rest of them (Quacquarelli, Turner & Sowter 2921)

Concept of Special Needs Education

Special needs education is a part and parcel of the general education with a set of specialized services, adaptations and modifications of contents, techniques, materials and instruction specially designed to meet the individual learning needs of children or

students who experience some types and degrees of difficulties that could significantly hamper their learning and development. According to Onuigbo (2022), special needs education or special education is a specialized educational programme that aims at using specialized methods, materials, facilities and services to meet the unique needs of exceptional learners so that they can maximize their potentials. Okeke (2001) defined special education as education provided within the general education, designed not only only to prevent, reduce or eliminate all conditions that produce significant defects in all-round functioning of exceptional persons but also designed to render specialized services directed towards meeting the individual needs of exceptional persons. In the National Policy on Education, Federal Republic of Nigeria (FRC 2013) put it that special education is a customized educational programme designed for children with special needs to meet their unique needs which the general education programmme cannot cater for. The policy stipulates that it is meant for children with visual impairment, hearing impairment, physical and health impairment, intellectual disabilities, emotional and behavioural disorders, speech and language impairment, learning disabilities, autism spectrum disorders and multiple disabilities. It also caters for the special needs of gifted and talented who need special educational programms to engage their extraordinary needs and endowments.

Students with special educational needs are, therefore, those who experience or manifest more than the usual difficulties and problems in learning and training as normally offered in regular schools (Obani 2006). Going further, Obani reiterated that they are those who need closer personal attention, some modifications and adaptations of the school routines and practices, general curriculum and approaches to teaching and learning in order to attain their optimum learning levels and development. They compose about 20 - 25 percent of every school or classroom population. They are not

only those who have obvious physical and functional impairments such as blindness, deafness/dumbness, lameness or intellectual disabilities of various levels of severity but also includes the ones that have social, psychological or cultural disabilities. Others include those who are rejected and stigmatized such as ex-convicts, former leprosy patients, former child prostitutes, street urchins and street children. Others are those who have other kinds of social disadvantages like being destitute, or poverty stricken, suffering from chronic illnesses, or those living in very rural remote environments which are not stimulating (Obani 2006). The Federal Republic of Nigeria (FBN) (2013), included the person with albinism with their vision and skin problems, lack of self-esteem, myths about albinism, stigmatization and stereotypes. As a result of all these conditions of persons with special needs, they are ineffective in coping with regular teaching and learning methods.

The purpose and objectives of Special Needs Education according to National policy on Special Needs Education (2015) includes:

i. To take care of total service delivery of the physical, mental and emotional disabilities of the Nigerian child, irrespective of setting (school, home and hospital).

ii. To provide adequate and qualitative education for all Persons with Special Needs in all aspects of national developmental endeavours.

iii. To ensure that all Persons with Special Needs develop at a pace commensurate with their abilities and to contribute to the nation's socioeconomic and technological development.

From the foregoing therefore, special education looks beyond the ordinary and provisions of the regular school system and then utilizes special techniques, special facilities and special services that considers remediating or tackling the problems of the conditions of the students.

Importance of curriculum innovation for students with special needs

Innovating curriculum for students with special needs is important for improving the effectiveness of the education system for them. With the level of the technological development in the society these days, the students with special needs require a curriculum that responds the economic, social and technological state of the time.

Curriculum innovation for students with special needs is necessary because in as much as some of these students have adequate capability to acquire learning from the general conventional curriculum with little special support, many of them will not benefit much from that if substantial modifications are not made to that curriculum. In order to achieve this, special educators, educational supervisors and psychologists need to work hand in hand to adjust the curriculum to meet the individual learning needs of the students with special needs.

Curriculum innovation for students with special needs is crucial because of the time in which the world is in now such as using technological tools in teaching and learning. Such innovations will not only be based on using technologies and hybrids academic achievements but also on self-help and living skills for the well-being of this category of persons in their communities. Equally, upgrading and modifying the education curriculum and facilities will enhance having a teaching and learning process that is student, and disability sensitive to provide an inclusive and effective learning environment for all. According to Organization cor Economic Cooperation and Development (OECD) (2021), countries and schools around the world are increasingly using different types of curriculum in order to close the gaps among different groups of students. Thus, curriculum is adapted to ensure that no learner is left behind, particularly the most vulnerable such as the ones with special needs and provides the

opportunity to think harder about equality, equity and inclusion in curriculum design and implementation.

If digital curriculum is adapted for students with special needs it can help them in different ways, thereby reducing equity gaps such as allowing students to continue learning outside school or in remote and rural areas like students being in hospital for their health reasons, dropout students learning from home, students in refugee camps as long as access to devices and internet connection is ensured. It helps in supporting students to continue learning during natural disasters or pandemics like during school closures due to the Covid-19 pandemic in 2020/21 and in Nigerian parlance due to industrial strikes. It also removes some barriers for students with physical disabilities with assistive technology. motivating others who seem disengaged in learning with the use of games and interactive tools. It enabling immigrant students to benefit from more access to digital dictionaries and translated learning materials. If digitalized, the curriculum supports students who are struggling in learning by providing 'real-time' feedback through AI tutors alongside with their teachers, so that they can make progress at their own pace, based on their prior knowledge, ability levels and learning needs (OECD 2021).

If a personalized curriculum in other words Individualized Educational Programme (IEP) is adapted rightly for students with special needs, has the potential to change the curriculum structure from a one-size-fits-all, linear learning-progression model to a differentiated, non linear learning-trajectory model, from which all students can benefit. A personalized curriculum allows students some degree of choice in content, pace of learning, and learning activities, and assessment. For example, assessment can be tailored to support students to set their individual learning goals, to provide more frequent and substantive feedback on progress and to diagnose potential learning

difficulties. This approach enables them to become aware of their personal interests and their talents, to make sense of why they learn, and to make connections between school life and their own social and cultural environment (OECD 2021).

Principles of curriculum innovation

Although there may be pressing need for or there are necessities for the innovation of the curriculum, the activity should not be done in haste, haphazardly nor out of rule. There are principles that ought to guide the innovation of the curriculum which include but not limited to the following as delineated by Ira et al (2023):

Principle of relevance. Relevance means that the components of curriculum objectives, content/learning experiences, organization and evaluation are compatible with the needs of society, both in terms of fulfilling the workforce and idealized citizens, including the delivery and evaluation processes.

The principle of continuity. The principle of continuity or continuity requires curriculum innovation that is vertically sustainable and horizontally sustainable. Vertically between one level of education with a higher level of education developed curriculum on an ongoing basis without any distance between them, from learning objectives to national education goals are also sustainable, as well as others. Meanwhile, horizontal sustainability means that curriculum

innovation at the same level of education and level/class is not discontinuous.

The principle of flexibility. Curriculum innovators must realize that the curriculum must be able to be adapted to local situations and conditions and the ever-evolving times without overhauling the educational goals that must be achieved.

Goal-orientated principle. Curriculum objectives contain aspects of knowledge, skills, attitudes and values, which in turn foster changes in the behaviour of learners that cover these three aspects and are related to the aspects contained in the educational objectives.

Principles of efficiency and effectiveness. Curriculum innovation must consider the efficient use of funds, time, energy and available resources in order to achieve optimal results. Limited funds must be used in such a way as to support the implementation of learning. The time available for students to learn at school is also limited and must be utilized appropriately in accordance with the subjects and learning materials required.

The principle of balance. With this balance, it is hoped that there will be a complete and comprehensive blend, with each contributing to personal development.

The principle of integration. With this integration, it is hoped that a round and complete person will be formed. In addition, integration is also implemented in the learning process, both in the interaction between students and teachers and between theory and practice.

Quality principle. Quality education is determined by the degree of quality of teachers, learning activities, quality equipment / media (Ira et al 2023).

Challenges of curriculum provision for students with special needs in Nigeria

1. The professional teachers trained as special educators to teach the students with special needs are scarce in the country. Due to this, many of the teachers of the students are not competently trained in implementing the teaching and learning principles and processes for developing the students they are teaching

2. Infrastructural facilities are inadequate. Special needs education is an equipment laden kind of programme. Therefore, when such specialized facilities are in short supply, innovative curriculum will be hard to come by.

3. There is no data in Nigeria on the population of persons with special needs enrolment in schools,and teachers attached to them. Where there is no data, setting and meeting up targets in curriculum innovation will be challenging.

4. Due to our Nigerian context in underfunding education, navigating a curriculum that is built to suit the learning needs of students with special is difficult.

5. The schools in rural and interior environment have no accessibility to electricity and lack assistive technologies like voice recognition systems, Braille devices, alternative keyboards and more.

6. In most cases in Nigeria, stakeholders such as students parents and communities are not involved involved in curriculum decision making and planning process. This is a hindrance to the success of the innovations required more especially as it affects students with special needs.

Way forward

In order to address the challenges facing innovation of the curriculum for students with special needs in the country, the following suggestions are postulated and recommended.

Federal, state and private universities and colleges of education should be mandated to establish special needs education departments so that more professional will be produced into the field. Equally crucial is the government should be organizing in-service programmes, workshops and seminars for teachers in the system to upgrade them in special education courses and services.

The government should increase the funding of education in general and special needs education in particular. This will help providing adequate instructional material, training and employment of more professionals into the field, providing assistive and technological tools and ensure effective innovation and implementation of curriculum for students with special needs in Nigeria.

Learning materials that are accessible as well as web tools that suit the learning needs students with special needs are required to be developed and included in the curriculum

The government should incorporate IEP learning into the school curriculum. This is essential, more especially now that inclusive education is being practised all over the

world so that students with special needs would be able to access adequate teaching and learning beneficial to him or her in any neighbourhood school he or she is enrolled in.

Teachers and headteachers should be supported to adapt appropriate study plans or programmes to suit the learning needs of the students with special needs and also involve parents and the immediate community for extracurricular activities

In the case of digital curriculum, technologies like accessible formats for braille readers,adapted language to ease off comprehension, speech to text and text to speech software and adaptable font sizes and colours and others in various forms are used to support students with special needs and break some of the barriers to their learning thereby enhancing equitable access chances to learn.

As the main purpose of curriculum innovation is concerned with improving the learning outcomes of students it is of critical importance that the stakeholders are involved. The students, parents and school community should have to share their views about how to maximize the utilization of whatever material, processes, facility, methodology or tools for the needs of the students (Adam et al 2014)

There is need to ensure that reliable and valid data of students with special needs in Nigeria exist in consistent with the aims and objectives of whatever innovations necessary. This makes for the effective planning and implementation of the curriculum. In the modern world, information of such importance are save in computerized systems and retrieved as the need arises.

Finally, inclusive curriculum is advocated in the country in which every student is recognized and valued based on who he/she is, changing the system to fit the student rather than changing the student to fit the system. This approach does not adopt the same standards for all learners but rather, it considers and values their unique needs, abilities, aspirations, talents, strengths and weaknesses. In doing so the curriculum endeavours to take off barriers to participation by students with special needs .

Conclusion

Seeing curriculum innovation from different angles in definition could mean creating of new contents of study, pedagogical processes or introducing new materials and

facilities for solving some problems in the education system which could arise from the demands of the society in tandem with social, economic political and technological development of the time and this comes true for students with special needs in Nigeria. In order to achieve this, there are principles to follow among which are goal orientation and efficiency and effectiveness. Though there are challenges facing curriculum innovation in special needs education in Nigeria, there are ways forward and government increasing funding to the education sector is crucial in the list.

Recommendations

Based on the foregoing discussion, the following recommendations are made:

1. The government should increase the funding of education in general and special needs education in particular for adequate running of innovative curriculum for students with special needs in secondary schools
2. Teachers and headteachers should be supported to adapt appropriate curriculum to suit the learning needs of the students with special needs.
3. Special educators, educational supervisors and psychologists need to work in synergy to modify the secondary school curriculum to meet the individual learning needs of the students with special needs.
4. The government should organize regular in-service programmes, workshops and seminars for teachers in the system to upgrade them in special education courses and services.
5. There should be advocacy for inclusive curriculum in secondary schools in the country in which every student is recognized and valued based on who he/she is, changing the system to fit the student rather than changing the student to fit the system.

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EFFECT OF USING NEW METHODS AND TECHNIQUES IN TEACHING IGBO GRAMMAR IN JUNIOR SECONDARY SCHOOLS IN NSUKKA LANGUAGE OF ENUGU STATE

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Abstract

This study investigates the effect of using new methods and techniques in teaching Igbo grammar in junior secondary schools within Nsukka Local Government Area, Enugu State. The traditional approach for teaching Igbo grammar often characterized by rote memorization and teacher centered instruction has proven inadequate in fostering students' grammatical competence and interest in the Igbo language. This research explores how innovative pedagogical strategies such as communicative language teaching (CLT), task-based language teaching (TBLT), and the use of instructional technologies influence students' understanding and application of Igbo grammar. The study adopted a quasi-experimental design involving two groups of JSS2 students: the experimental group received instruction through modern methods, while the control group was taught using conventional techniques. Data were collected through pre-test and post-tests, classroom observations, and student questionnaires. Result revealed that students taught with new methods demonstrated significantly higher performance in grammar tasks and showed greater engagement and motivation in learning Igbo. These findings underscore the importance of adopting learner-centered, interactive approaches to improve language learning outcomes in indigenous language education. The study recommends the integration of modern teaching methods into the curriculum, alongside continuous teacher training and provision of relevant teaching resources, to revitalize Igbo language instruction in Nigerian schools.

Keywords: Igbo grammar, teaching methods, junior secondary school, language learning, Nsukka, communicative approach

Introduction

Language serves as a vital tool for communication, cultural preservation, and national identity. In a multilingual country like Nigeria, the teaching and learning of indigenous languages such as Igbo play an essential role in sustaining cultural heritage and promoting national integration. However, the effective teaching of Igbo grammar, which is central to mastering the language, has been hindered by various challenges. These include the use of outdated instructional methods, a lack of instructional materials, and dwindling student interest (Eze, 2014; Okeke & Okwudishu, 2018). These issues underscore the urgent need to explore innovative approaches in language pedagogy to improve learning outcomes.

Modern pedagogical approaches emphasize learner-centered, interactive, and technologically enhanced instruction, offering a sharp contrast to the traditional, teacher-centered methods still prevalent in many Igbo language classrooms. Methods such as communicative language teaching (CLT), task-based learning, and the incorporation of digital tools—such as mobile applications, multimedia resources, and interactive games—have shown promise in language education across diverse settings (Richards & Rodgers, 2014). These methods provide opportunities to present abstract grammatical concepts in a more engaging and accessible manner, particularly for young learners.

Research supports the effectiveness of such innovative strategies. Nwaozuzu (2017) recommends the use of dramatization, storytelling, and culturally relevant instructional materials in Igbo language instruction to increase learner engagement and understanding. Similarly, Ihuoma and Anyakoha (2020) reported that the use of audio-visual aids significantly improved students' retention and understanding of Igbo grammatical structures. These findings suggest that new methods not only enrich the learning environment but also enhance cognitive and affective outcomes in language acquisition.

Furthermore, the integration of information and communication technology (ICT) has transformed language teaching globally. ICT tools provide individualized learning experiences, facilitate real-time feedback, and offer diverse, multimodal content that can improve grammatical competence (Yusuf & Onasanya, 2017). In the context of Igbo grammar, such technologies can bridge the gap between classroom learning and real-life language use.

Despite these benefits, the adoption of innovative teaching strategies in Igbo grammar instruction remains limited. Therefore, this study investigates the impact of new teaching methods and techniques on the learning of Igbo grammar. The goal is to identify effective strategies that can revitalize the teaching of Igbo grammar and enhance student achievement in the subject.

Objectives of the Study

The overarching goal of this study is to investigate the effectiveness of innovative instructional methods and techniques in enhancing the teaching and learning of Igbo grammar in junior secondary schools within Nsukka Local Government Area of Enugu State. Specifically, the study seeks to:

1. Examine the traditional methods currently used in teaching Igbo grammar in junior secondary schools and identify their limitations in fostering student engagement and understanding.
2. Identify and describe new pedagogical methods and techniques such as communicative language teaching (CLT), task-based learning (TBL), and technology-integrated instruction—that are being introduced or can be applied in teaching Igbo grammar.
3. Assess the comparative impact of these new methods on students' performance and interest in Igbo grammar relative to traditional teaching methods.
4. Explore teachers' perceptions and preparedness for adopting and implementing these new methods and techniques in their instructional practices.

Hypothesis

Hypothesis 1: There is no significant difference in academic performance in Igbo grammar between students taught using new methods and those taught with conventional methods.

Hypothesis 2: There is no significant difference in students' interest in learning Igbo grammar due to the method of instruction.

Literature Review

The Importance of Mother Tongue Education

Language plays a pivotal role in cultural transmission, identity formation, and intellectual development. The Igbo language, being one of Nigeria's major indigenous languages, is critical to the socio-cultural and educational development of learners in the South-East region, including Nsukka Local Government Area (Eze & Nnadozie, 2018). Research has shown that teaching grammar in the mother tongue enhances

cognitive abilities, promotes language proficiency, and preserves cultural heritage (Okoro & Nnamani, 2020). Unfortunately, Igbo grammar instruction at the junior secondary level has been marked by poor learner interest, insufficient resources, and outdated teaching methods (Nwachukwu, 2017).

Traditional Methods of Teaching Igbo Grammar

Traditional teaching approaches in Igbo grammar often rely on rote memorization, teacher-centered lectures and insufficient learner participation (Eme & Mbagwu, 2011). These methods have been criticized for being ineffective in fostering communicative competence or deep grammatical understanding among learners. Studies such as that by Nwachukwu (2017) reveals that students exposed to such conventional methods demonstrated low retention and practical application of grammatical rules. This method rarely considers learners' linguistic background or real-life language use, leading to reduced engagement and poor academic outcomes.

New Methods and Techniques in Language Teaching

The shift from traditional to modern methods has brought about techniques such as Communicative Language Teaching (CLT), Task-Based Language Teaching (TBLT), and the use of technology in language instruction (Azu & Okonkwo, 2019). These approaches prioritize learner interaction, problem-solving, and contextualized use of language over memorization. CLT, in particular, emphasizes functional language use in real-life scenarios, which is essential for grammar acquisition (Larsen-Freeman, 2015). In the Igbo language context, integrating such methods has been proposed as a way to make grammar lessons more interactive and relevant (Okeke, 2021).

Furthermore, the use of audiovisual materials, local cultural content, and language games have been found to improve grammar learning and retention (Onuigbo & Eyisi, 2012). These materials contextualize grammar instruction, making it relatable to students' daily lives.

Effectiveness of New Igbo Grammar Instruction

The teaching of Igbo grammar in contemporary educational settings has undergone significant transformation due to the integration of modern instructional strategies. These methods, which include communicative language teaching, technology-aided instruction, task-based learning, and contextualized grammar exercises, have demonstrated considerable effectiveness in enhancing learners' proficiency in Igbo grammar.

One of the key strengths of modern Igbo grammar instruction is its shift from rote memorization to interactive, learner-centered approaches. Research by Okeke and Mbah (2020) reports that students exposed to communicative and contextualized grammar teaching techniques performed significantly better in grammar usage and sentence construction than those taught through traditional methods. This finding underscores the importance of engaging students actively in meaningful language use rather than focusing solely on grammatical rules.

Incorporating Information and Communication Technology (ICT) tools such as language learning apps, audio-visual materials, and online resources has also contributed positively to learners' motivation and comprehension (Nwachukwu & Ede, 2021). ICT integration not only makes grammar lessons more interesting but also caters for diverse learning styles, thus improving retention and application of grammatical concepts.

Furthermore, the task-based learning approach, which requires students to use grammatical structures to complete real-life communicative tasks, has been shown to improve both written and spoken proficiency in Igbo. Studies reveal that students who participate in tasks such as dialogue creation, storytelling, and role-playing exhibit greater confidence and grammatical accuracy (Uzoegwu, 2019).

However, the effectiveness of these modern methods relies heavily on teachers' competence and willingness to adopt innovative instructional practices. Teacher training and provision of adequate instructional materials remain critical for maximizing the benefits of these approaches.

Challenges in Implementing Modern Teaching Techniques in the Igbo Grammar Classroom

The implementation of modern teaching techniques in the Igbo grammar classroom is essential for promoting learner engagement, communicative competence, and cultural literacy. However, several challenges impede the effective integration of these methods in junior secondary schools, particularly in regions such as Nsukka Local Government Area of Enugu State.

One significant challenge is the lack of instructional materials and resources. Modern techniques, such as communicative language teaching, task-based learning, and the use of audiovisual aids, require adequate teaching resources, including digital tools, projectors, and well-equipped language laboratories. Unfortunately, many Igbo

language classrooms are under-resourced, limiting teachers' ability to incorporate these methods effectively (Okebukola, 2018).

Another challenge is the limited teacher competence in modern pedagogical strategies. Many Igbo language teachers have been trained predominantly in traditional grammar-translation methods and may lack the necessary skills to adopt learner-centered and technologically driven approaches (Obiefuna & Offorma, 2014). This gap in professional development contributes to the persistence of rote memorization and passive learning.

Additionally, there exists low motivation and negative attitudes among students towards learning Igbo grammar. The dominance of English and other global languages have contributed to a declining interest in the Igbo language, making it difficult for teachers to apply interactive and participatory techniques that rely on active learner involvement (Nkamigbo & Okeke, 2015).

Curriculum limitations and examination-oriented teaching also pose a barrier. The current curriculum and assessment practices often emphasize grammatical accuracy over communicative competence, discouraging teachers from using methods that prioritize real-life language use and interactive communication (Oluikpe, 2013).

Lastly, socio-cultural factors and parental influence play a role. Some parents discourage their children from learning Igbo, perceiving it as less economically beneficial compared to English or other foreign languages, which undermines both the demand for and the effectiveness of modern teaching practices in the subject (Eme & Mbagwu, 2011).

Methodology

Research Design

This study adopted a quasi-experimental design involving pre-test and post-test control group formats. This design was chosen to examine the effectiveness of new teaching methods and techniques on students' performance in Igbo grammar without random assignment of participants. The quasi-experimental approach allows for the observation of cause-and-effect relationships in a real school setting while maintaining a degree of control over extraneous variables (Creswell & Creswell, 2018).

Scope of the Study

The study was conducted in Nsukka Local Government Area, Enugu State, Nigeria. The area is predominantly inhabited by the Igbo ethnic group and has several public and private junior secondary schools where Igbo language is part of the curriculum.

Population of the Study

The target population comprised all Junior Secondary School II (JSS II) students in public secondary schools within Nsukka LGA. This group was selected because they have already been introduced to foundational aspects of Igbo grammar and are cognitively ready for more advanced content.

Sample and Sampling Technique

A total of 120 students from four randomly selected public junior secondary schools were used as the sample. A multistage sampling technique was employed: first, four schools were randomly selected from the list of government-owned secondary schools in Nsukka LGA. Then, two intact classes (60 students in the experimental group and 60 in the control group) were assigned based on existing class structures to avoid disruption to school schedules.

Instrumentation

The main instrument for data collection was the Igbo Grammar Achievement Test (IGAT), developed by the researchers. The test comprised 40 multiple-choice items covering various aspects of Igbo grammar including parts of speech, sentence structure, concord, and tense usage. The instrument was validated by three experts in Igbo language education and measurement and evaluation from the University of Nigeria, Nsukka.

A pilot test was conducted on 30 students outside the sample to determine the reliability of the instrument. Using the Kuder-Richardson Formula 20 (KR-20), a reliability coefficient of 0.82 was obtained, indicating high internal consistency.

Procedure for Data Collection

The study spanned a period of six weeks. In the first week, a pre-test was administered to both groups to determine baseline equivalence. The experimental group was taught using innovative methods and techniques such as role play, collaborative learning, games, and use of digital audio-visual materials. The control group received instruction through the traditional lecture method. Teaching was conducted three times a week by the regular Igbo teachers who were trained by the researchers on how to apply the new methods. At the end of the sixth week, a post-test (the same as the pre-test but with reshuffled items) was administered to both groups to measure learning outcomes.

Method of Data Analysis

Data obtained from the pre-test and post-test were analyzed using mean, standard deviation, and Analysis of Covariance (ANCOVA). Mean and standard deviation were

used to compare the performance of the groups, while ANCOVA was used to test the hypotheses at a 0.05 level of significance, controlling for pre-test differences.

Results and Data Analysis

This section presents the results from the data collected to examine the impact of new methods and techniques in teaching Igbo grammar in junior secondary schools in Nsukka Local Government Area, Enugu State. Data were analyzed using both descriptive and inferential statistical tools. The major aim was to determine whether the adoption of innovative teaching strategies significantly enhanced students' achievement and interest in Igbo grammar.

- Demographic Characteristics of Respondents

A total of 120 Junior Secondary School students participated in the study, selected from four schools through stratified random sampling. The demographic data indicated a nearly equal distribution of male (52%) and female (48%) students across the selected schools in JSS2.

- Descriptive Statistics

Descriptive statistics were used to assess the performance of students before and after the intervention.

Table 1: Mean and Standard Deviation of Pre-test and Post-test Scores

	Group N	Mean (Pre-test)	SD (Pre-test)	Mean (Post-test)	SD (Post Test)
Experimental Group	60	45.30	8.15	72.85	7.42
Control Group	60	44.75	7.88	52.40	6.95

The experimental group, which was taught using innovative techniques such as dramatization, role play, digital flashcards, and communicative grammar teaching, showed a significant improvement in post-test scores (M = 72.85, SD = 7.42). The control group, taught using conventional lecture-based methods, also improved, but to a lesser degree (M = 52.40, SD = 6.95).

- Inferential Statistics

To test the hypotheses, paired sample t-tests and independent sample t-tests were employed.

Hypothesis 1: There is no significant difference in academic performance in Igbo grammar between students taught using new methods and those taught with conventional methods.

Table 2: Independent Samples T-Test on Post-test Scores

Variable	t	df	Sig. (2-tailed)
Post-test Scores	15.36	118	.000

The t-test result indicates a statistically significant difference in post-test scores between the experimental and control groups ($t(118) = 15.36$, $p < .001$). This implies that students taught with new methods performed significantly better than their counterparts taught with traditional methods.

Hypothesis 2: There is no significant difference in students' interest in learning Igbo grammar due to the method of instruction.

Interest was measured using a 20-item Likert-scale questionnaire rated on a 4-point scale. The results are summarized below.

Table 3: Mean Interest Scores

Group	N	Mean Score	SD
Experimental Group	60	3.58	0.45
Control Group	60	2.72	0.52

The results show a higher mean interest score for the experimental group, indicating increased engagement and motivation among students taught with new methods. An independent t-test confirmed the statistical significance of this difference ($t(118) = 10.42$, $p < .001$).

- Qualitative Feedback

Qualitative data collected from teachers and students through interviews and open-ended questionnaires revealed that the use of interactive and digital methods fostered a deeper understanding of grammatical structures, improved participation, and reduced anxiety in speaking and writing Igbo.

Summary of Findings

Students taught using new instructional methods demonstrated significantly higher achievement and interest in Igbo grammar.

Innovative methods encouraged active student participation and made abstract grammar rules more relatable and memorable.

Teachers observed greater classroom engagement and improved attitude toward learning Igbo grammar.

Discussion

The findings from this study highlight the positive impact of employing new methods and techniques in the teaching of Igbo grammar in junior secondary schools within Nsukka Local Government Area, Enugu State. The analysis revealed that students taught with innovative strategies such as interactive group activities, gamification, audio-visual materials, and context-based learning performed significantly better in grammar comprehension, application, and retention compared to those taught using traditional methods like rote memorization and lecture-based instruction.

These findings are consistent with the socio-constructivist theory of learning, which emphasizes the active involvement of learners in the construction of knowledge through interaction and engagement (Vygotsky, 1978). The use of learner-centered approaches allowed students to relate grammatical structures to real-life situations, thereby deepening their understanding and promoting long-term retention. In addition, the integration of technology, such as educational videos and digital language apps, not only captured learners' interest but also addressed various learning styles, aligning with the principles of differentiated instruction (Tomlinson, 2001).

Furthermore, the study supports previous research by Okonkwo and Eze (2019), who reported that the use of culturally relevant teaching aids and participatory methods in indigenous language instruction enhances students' engagement and linguistic competence. Similarly, Nnamani and Uba (2020) found that the use of dramatization and storytelling techniques in Igbo language teaching significantly improved students' grammatical accuracy and fluency. The current study extends these findings by showing that a hybrid approach that combines traditional elements with modern pedagogical innovations can yield even greater results.

Another notable observation was the increased motivation and interest in Igbo language classes among students exposed to the new methods. This challenges the widely held belief that students are generally disinterested in learning indigenous languages. Rather, the disinterest appears to be a reflection of outdated and ineffective teaching practices. By revitalizing the curriculum and teaching style, educators can reawaken students' appreciation for their mother tongue.

However, the study also revealed some challenges, such as a lack of adequate training for teachers and insufficient teaching resources, which hinder the full implementation of innovative methods. Addressing these challenges requires a concerted effort by

government agencies, school administrators, and curriculum developers to invest in teacher training and the provision of instructional materials.

Implication of the Theories on the Study

Using new instructional methods such as games, role play, storytelling, and digital simulations aligns with constructivist ideals by promoting active engagement and scaffolding learners' understanding of complex grammatical rules in the Igbo language. These approaches help to bridge the gap between abstract grammatical concepts and students' lived experiences, thereby improving retention and application.

Applying Vygotsky's Sociocultural Theory, the use of collaborative techniques such as group work, peer teaching, and dialogic teaching in Igbo grammar instruction can foster deeper understanding. Language is both the object and the medium of instruction, and thus students benefit from social negotiation of meaning and contextualized grammar usage (Lantolf & Thorne, 2006).

For Igbo grammar instruction, incorporating CLT inspired techniques such as interactive dialogues, real-life simulations and use of culturally relevant materials can enhance learners grammatical competence while simultaneously fostering fluency and confidence in language use. This approach supports both the functional and structural aspects of grammar.

Conclusion

The results have demonstrated that the adoption of new methods and techniques in teaching Igbo grammar significantly enhances students' academic performance, interest, and overall learning experience in junior secondary schools in Nsukka LGA. The evidence suggests that interactive, learner-centered, and contextually relevant instructional strategies are more effective than traditional methods in fostering grammatical competence in the Igbo language.

The implication is clear, it will help to improve outcomes in Igbo grammar instruction, educators and policymakers must embrace innovative pedagogical practices. Training programs for teachers should focus on equipping them with modern teaching skills and strategies tailored to the linguistic and cultural context of learners. In addition, educational stakeholders should prioritize the integration of multimedia tools and culturally appropriate content in Igbo language instruction. Ultimately, revitalizing indigenous language education through innovative teaching holds promise not only for linguistic proficiency but also for cultural preservation and identity development among Nigerian youth. Also, while modern teaching techniques offer promising opportunities

for enhancing Igbo grammar instruction, these challenges must be addressed through improved teacher training, provision of teaching resources, curriculum reform, and the promotion of positive attitudes towards indigenous language learning.

Recommendations

Based on the findings of this study on the impact of using new methods and techniques in teaching Igbo grammar, the following recommendations were made:

- Igbo language teachers should adopt innovative and interactive teaching methods such as communicative language teaching (CLT), problem-solving approaches, role-playing, and the use of multimedia resources to make Igbo grammar lessons more engaging and effective for students.
- The government and educational authorities should organize regular seminars, workshops, and in-service training for Igbo language teachers to update their knowledge and skills on the use of modern instructional techniques for teaching grammar.
- Provision of Instruction Schools should be adequately equipped with relevant teaching and learning materials such as charts, grammar games, flashcards, audio-visual aids, and ICT tools that can enhance the teaching and learning of Igbo grammar.
- The curriculum planners should review the existing Igbo language curriculum to incorporate modern methods and techniques that encourage learner-centered and activity-based teaching approaches in grammar lessons.
- Teachers should shift from the traditional teacher-centered methods to student-centered approaches where learners are actively involved in grammar exercises, group discussions, peer teaching, and practical language use.
- School heads and administrators should support teachers by providing an enabling environment for the implementation of new teaching techniques, including flexible timetabling, provision of resources, and encouragement for teacher innovation.
- Parents and the community should be sensitized on the importance of using modern methods in teaching the Igbo language, and they should encourage the use of Igbo at home to reinforce what is taught at school.

- Scholars and researchers should carry out further studies on the use of modern methods in teaching other aspects of the Igbo language such as literature, oral traditions, and phonology, to build a comprehensive body of knowledge in this field.

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INTEGRATING ROBOTIC TECHNOLOGY IN FOSTERING ACTIVE LEARNING IN PRE-PRIMARY AND PRIMARY EDUCATION IN THE 21ST CENTURY.

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Abstract
The integration of robotic technology has the potential to enhance active learning, foster creativity and develop 21st century skills among young learners. This paper uncovers the role of robotics in facilitating engaging hands-on learning experiences for pre-primary and primary education children. The paper affirmed that robotics technology improved cognitive skills, enhanced problem-solving abilities and the promotion of collaboration and critical thinking. Regardless of it benefits, the challenges and limitations faced in implementing robotics in the classroom is as a result of high costs, lack of teacher training and limited access to technology. Practical strategies for successful implementation are discussed, alongside the implications for policy and practice in educational systems. The paper concludes by emphasising the need for equitable access to robotics tools, teacher professional development and curriculum reform to fully capitalise on the educational potential of robotics technology. The paper provides recommendations for policymakers and educators to ensure the effective integration of robotics in fostering active learning in pre-primary and primary education and that governments should develop clear policies that outline the integration of robotics into the educational system.

Keywords: Robotic Technology, Active Learning, Pre-Primary Education, Primary Education, 21st Century Skills.

Introduction

In the 21st century, education systems across the globe are undergoing a rapid transformation due to the infusion of digital technologies particularly robotic technology. In pre-primary and primary education, the integration of robotics is increasingly being recognised as a powerful tool for fostering active learning. Active learning which involves young learners direct engagement in the learning process through activities and problem-solving is essential in developing"4Cs" such; Critical thinking, Creativity, Collaboration and Communication skills that are vital for success in the modern world (Trilling & Fadel, 2019). In educational contexts, robots are used not merely as tools but as learning companions that stimulate curiosity and engagement. According to Alimisis, (2020) robotic technology refers to programmable devices that can perform tasks and interact with learners in a tangible and dynamic way.

For young learners, robots such as Bee-Bot, Dash and Dot and LEGO Education sets are specifically designed to provide age-appropriate, hands-on learning experiences that make abstract concepts more concrete and understandable (Eguchi, 2018). These robots are equipped to facilitate learning through play, storytelling, coding, and collaborative problem-solving tasks. The early integration of robotic technology aligns with constructivist theories of learning, particularly those of Piaget and Vygotsky, which emphasise that children learn best when they actively construct their own understanding through interaction with their environment and with others. Robotic tools in classrooms create interactive learning environments where learners explore, manipulate and test ideas, thereby deepening their understanding. For example, study by Bers, (2018) show that when young children engage in programming robots, they develop not only cognitive skills like sequencing and logical reasoning but also social skills such as turn-taking and communication.

Indeed, Robotic-Assisted Education (RAE) has been shown to enhance inclusivity and cater for different learning styles. It supports differentiated instruction by providing visual, auditory, and kinesthetic learning experiences, making learning more accessible for children with diverse needs, including those with learning disabilities (Mubin, Stevens, Shahid, Al Mahmud & Dong, 2021). Also, robotics can serve as a bridge between traditional and digital literacy's that allow children to navigate the modern technological world with competence and confidence. The 21st century learning environment calls for a paradigm shift in teaching methodologies from teacher-centered to learner-centered approaches.

Robotic integration supports this shift by placing learners at the center of discovery, experimentation and problem-solving. It also prepares young learner for future careers in science, technology, engineering and mathematics (STEM) by building foundational skills in coding and computational thinking at an early age (Sullivan & Bers, 2016). Notwithstanding the numerous benefits, integrating robotics in pre-primary and primary education also comes with challenges, such as high cost of equipment, limited teacher training and infrastructural deficits in low-income regions. However, with increasing policy support, teacher development programmes and innovations in low-cost educational robotics, these challenges are gradually being addressed. (Alimisis, 2020).

Conceptual Clarifications

Robotic Technology:

Robotic technology encompasses a multidisciplinary field that integrates mechanical, electrical and computer engineering to design, construct and operate robots capable of performing tasks traditionally executed by humans. Indeed, robotics is a branch of engineering that involves the conception, design, manufacture and operation of robots

which aims to create intelligent machines that assist humans in various ways. This includes applications like robotic process automation (RPA) which simulates human interaction with software to perform repetitive tasks (UNESCO-UNEVOC, 2025). According to the Journal of Applied Robotics and Artificial Intelligence (2025), robotic technology is utilised to automate and control processes such as manufacturing and assembly. It is a rapidly growing field with applications in space exploration, medical procedures, and other tasks, enhancing safety, accuracy, and efficiency.

Robotics technology is an interdisciplinary field combining mechanical, electrical, electronic and computer science engineering. Robots are designed to perform tasks more reliably and quickly than humans, with applications in various sectors (IJERT, 2025). TechTarget (2025) defines robotics as "an interdisciplinary sector of science and engineering dedicated to the design, construction and use of mechanical robots." This includes various disciplines such as electrical, information, software, control systems, and mechanical engineering, along with computer science, mathematics and Artificial Intelligence (AI). Built, (2025) explains that robotics is the intersection of science, engineering and technology that produces machines called robots which replicate or substitute for human actions. Robots perform basic and repetitive tasks with greater efficiency and accuracy than humans, making them ideal for industries like manufacturing.

Active Learning in Early Childhood Education

Active learning involves learners actively constructing their own understanding of the world through direct experiences, rather than passively receiving information from a teacher or textbook (Pica, 2016). Scholars have emphasised various facets of active learning in early childhood settings. For example, Green and Gredler (2012) argue that active learning promotes engagement by encouraging children to make decisions, solve

problems and engage in discussions, thus fostering deeper learning. Active learning is also seen as integral to the development of critical thinking skills, as it requires children to reflect on their actions and outcomes (Alfieri Brooks, Aldrich & Tenenbaum, 2017). A key aspect of active learning in early childhood education is the teacher's role as a facilitator rather than a direct instructor. Teachers who adopt an active learning approach create an environment that encourages inquiry and exploration. According to Edwards (2012), teachers should design activities that allow children to explore their interests, ask questions, and make discoveries. This approach supports the idea that children are capable of being active agents in their own learning, which aligns with the principles of autonomy and agency in early childhood education (Bodrova & Leong, 2017). Active learning is not limited to cognitive development but also plays a crucial role in emotional and social development. Through interactive and collaborative activities, children learn important social skills such as sharing, cooperation, and conflict resolution.

Benefits of Integrating Robotic Technology in Pre-Primary and Primary Education

The integration of robotic technology in pre-primary and primary education offers a wide range of pedagogical, cognitive and social benefits. As education systems embrace 21st century learning goals, robotics have emerged as a key innovation that supports active, experiential and inclusive learning from an early age.

- ***Enhances Cognitive Development and Problem-Solving Skills***: Robotics promotes cognitive development by engaging children in tasks that require planning, sequencing and logic. When children programme or manipulate robots, they learn how to break complex tasks into manageable steps, which strengthens their problem-solving and critical thinking skills. According to Bers (2018) early

exposure to robotics supports the development of computational thinking a foundational skill for understanding technology and solving real-life problems logically and efficiently.

- ***Encourages Active and Experiential Learning***: Robots facilitate learning by doing which is crucial in early childhood education. Active engagement with physical objects such as programming a robot to follow a path or complete a task fosters deep learning and retention. Sullivan and Bers (2016) found that children who worked with educational robots demonstrated higher engagement and better learning outcomes compared to traditional instruction.
- ***Supports Creativity and Innovation****:* Robotic activities often involve storytelling, design and creative problem-solving. Children use robots in imaginative ways, such as designing obstacle courses, role-playing, or constructing narratives around robot characters. These tasks cultivate creativity, encourage open-ended thinking, and allow learners to express themselves in diverse and innovative ways (Eguchi, 2018).
- ***Improves Collaboration and Communication Skills****:* Robotics often involves teamwork, where children must share roles, communicate instructions, and solve problems together. These collaborative tasks enhance interpersonal skills and teach children how to work respectfully in a group. Studies by Mubin, Stevens, Shahid, Al Mahmud & Dong, (2021) emphasise the social benefits of robotics in classrooms, highlighting improved cooperation, empathy, and peer learning.
- ***Promotes Inclusivity and Differentiated Learning****:* Robotics supports multiple learning styles visual, auditory and kinesthetic making lessons more inclusive. It can be adapted to support learners with disabilities or those needing special attention. Robots can be used to personalize learning experiences, catering to individual learning paces and preferences (Ching, Hsu & Baldwin, 2020).

Challenges and Limitations of Integrating Robotic Technology in Pre-Primary and Primary Education

While robotic technology offers numerous benefits for pre-primary and primary education, its integration also presents several challenges and limitations that must be addressed to ensure its effective and equitable use. These challenges span across economic, technical, pedagogical and institutional dimensions especially in developing countries.

- ***High Cost of Implementation****:* One of the most tentative barriers to the adoption of robotics in early education is the high cost of robotic kits, maintenance and required infrastructure. Many schools especially in low-income and rural areas struggle to meet basic educational needs by making the purchase of robotic tools a low priority. As noted by Alimisis (2020) financial constraints hinder equitable access to robotics and deepen the digital divide among learners.
- ***Limited Teacher Training and Expertise****:* Successful integration of robotic technology relies heavily on the capacity of teachers to use it effectively. However, many educators lack the technical know-how and pedagogical skills to incorporate robotics into their lessons. Without proper training and continuous professional development teachers may feel overwhelmed or resistant to using such technologies in the classroom (Eguchi, 2018). This limitation can lead to under-utilisation or misapplication of robotics tools.
- ***Inadequate Infrastructure and Technical Support****:* Effective implementation of robotics requires reliable electricity, internet access and dedicated classroom space resources that are often lacking in many public schools. Also, the absence of technical support personnel to troubleshoot issues with devices can lead to disruptions and discourage teachers from sustained use (Mubin *et al*., 2021).

- ***Curriculum Misalignment****:* In many educational systems especially those with rigid or exam-oriented curricula, robotics may be seen as a peripheral or extracurricular activity rather than an integral part of learning. Integrating robotics meaningfully into national or regional curricula remains a challenge particularly where there is a lack of clear learning outcomes or assessment strategies for robotics-related activities (Ching Hsu & Baldwin, 2020).

Practical Strategies for Implementing Robotic Technology in Pre-Primary and Primary Education

The successful integration of robotic technology in pre-primary and primary education requires thoughtful planning, teacher preparedness, supportive infrastructure and learner-centered approaches. The following practical strategies can serve as a guide for educators, administrators, and policymakers seeking to harness the educational potential of robotics for young learners.

- ***Start with Simple, Age-Appropriate Robotic Tools****:* To ensure accessibility and engagement for young children, educators should begin with easy-to-use, age-appropriate robots such as Bee-Bots, Cubetto or Dash and Dot. These tools are designed with early learners in mind and often use tangible, visual programming interfaces rather than complex coding languages. According to Bers (2018) these simple robots help develop foundational computational thinking without overwhelming learners.
- ***Provide Ongoing Professional Development for Teachers****:* Teachers need continuous training and support to build competence and confidence in using robotics effectively in the classroom. Workshops, online courses, peer learning communities and mentoring programmes should be organised to introduce educators to both the technical and pedagogical aspects of robotics. Eguchi (2018) emphasises

that teacher preparedness is crucial for meaningful technology integration and recommends hands-on, practice-based training over one-time seminars.

- ***Integrate Robotics into the Existing Curriculum***: Robotics should not be treated as a separate subject but integrated into subjects like mathematics, science, language arts and social studies through interdisciplinary projects. For example, programming a robot to measure distance can reinforce math concepts, while storytelling with robots can enhance literacy. Sullivan and Bers (2016) found that integrated robotics project increased engagement and improved learning outcomes across subject areas.
- ***Use Project-Based and Inquiry-Based Learning Approaches***: Robotics is most effective when embedded in project-based learning (PBL) or inquiry-based frameworks where children explore real-world problems, ask questions and create solutions using robots. This approach promotes critical thinking, collaboration, and creativity. According to Trilling and Fadel (2019), PBL supports 21^{s}-century skills and makes learning more relevant and meaningful.
- ***Encourage Collaborative Learning and Peer Interaction***: Activities involving robotics should be structured to promote group work, where learners share roles such as programmer, builder and tester. This not only reduces the need for many robotic kits but also fosters teamwork, communication and problem-solving skills. Mubin *et al.* (2021) noted that robotics provides a natural setting for peer learning and cooperative engagement.
- ***Create a Supportive Infrastructure****:* A conducive learning environment should be established with adequate power supply, safe storage for robotic kits, internet access (if needed) and a flexible classroom layout for hands-on activities. Investment in basic infrastructure ensures that robotics tools are used consistently and effectively (Alimisis, 2020).

Implications for Policy and Practice

The integration of robotic technology in pre-primary and primary education holds substantial potential to transform the learning environment, but its success depends on the development of sound policies and practices. Policymakers, educators and stakeholders must consider various factors to ensure that robotics-based education is equitable, sustainable and aligned with broader educational goals. Therefore, the following are the implications for policy and practice that can guide the successful integration of robotics in early education.

- ***Policy Development and Strategic Planning****:* Governments and educational bodies should develop clear policies that outline the integration of robotics into the national curriculum. This includes setting standards for educational robotics, allocating funds for technology acquisition and ensuring long-term sustainability. According to Alimisis (2021), a coherent policy framework is essential for scaling robotics initiatives and preventing fragmented or short-term approaches. These policies should prioritize equitable access to robotic tools across different regions especially underserved or rural areas.
- ***Curriculum Reform to Incorporate Robotics****:* Curriculum development must evolve to integrate robotics and computational thinking as essential components of early education. Robotics should not be relegated to extracurricular activities, but instead woven into subjects such as mathematics, science, language, and social studies. As suggested by Trilling and Fadel (2019), modern curricula should embrace cross-disciplinary learning and foster critical thinking, creativity, and problem-solving all of which robotics can enhance. Curriculum reform should also involve defining clear learning outcomes related to robotics and computational thinking.

- ***Investment in Teacher Professional Development****:* For successful implementation of robotics in classrooms, teacher training must be a top priority. Policymakers should support the creation of comprehensive professional development programmes that equip teachers with the necessary technical and pedagogical skills. According to Bers (2018), ongoing training should not only cover the use of robotics tools but also the best pedagogical approaches for incorporating robotics into early childhood education. Collaboration with universities, tech companies and international robotics organisations can help design effective professional development programmes.
- ***Ensuring Equitable Access to Technology****:* One of the primary challenges in integrating robotics into education is ensuring that all children have equal access to the necessary resources. Policymakers should work to reduce the digital divide by investing in technology infrastructure, particularly in low-income or rural areas. Mubin et al. (2021) highlight the need for equitable access to high-quality robotics tools and internet connectivity as well as support for schools in purchasing and maintaining these resources. Grants, subsidies and public-private partnerships can help achieve this goal.
- ***Developing Inclusive Practices for Diverse Learners****:* Incorporating inclusive education practices is critical to ensuring that robotics benefits all children including those with special needs or from marginalized backgrounds. Policies should mandate that robotics tools and activities are designed to accommodate diverse learning styles and disabilities. According to Ching *et al.* (2020), inclusive practices might involve adapting robotic kits with accessible features such as tactile controls, voice prompts or customizable interfaces. Educators should be trained to implement

differentiated instruction strategies by ensuring that robotics education is accessible to every learner.

Conclusion

The integration of robotic technology in pre-primary and primary education represents a promising avenue for fostering active learning and preparing children for the demands of the 21st century. By engaging young learners in hands-on, interactive tasks, robotics not only make learning more exciting and meaningful but also nurtures important cognitive and social skills such as problem-solving, collaboration and creativity. However, the successful integration of robotics requires addressing several challenges such as; high costs, lack of infrastructure and insufficient teacher training. By focusing on age-appropriate tools, providing adequate professional development for educators and ensuring equitable access to technology, educational systems can overcome these barriers and unlock the full potential of robotics in early education. Policymakers and educational leaders must adopt forward-thinking strategies that includes curriculum reforms and industry partnerships to create a supportive environment for robotics-based learning.

Recommendations

Based on the discussions, the following recommendations were made;

1. Policymakers and educational authorities should revise curricula to incorporate robotics and computational thinking as core subjects. This integration should emphasise interdisciplinary learning where robotics complements existing subjects such as mathematics, science and language arts. Educational frameworks should focus on developing skills such as critical thinking, creativity and problem-solving through robotics activities.

2. Governments should develop clear policies that outline the integration of robotics into the educational system. These policies should include long-term funding strategies, infrastructure development and regulations that ensure all schools have access to high-quality robotics tools.
3. Teacher training is critical for the successful implementation of robotics in the classroom. Governments and educational institutions should invest in comprehensive professional development programmes that equip teachers with the necessary technical and pedagogical skills. These programmes should provide teachers with hands-on experience with robotics tools, effective teaching strategies and ways to integrate robotics into the curriculum.
4. Schools should form partnerships with technology companies, universities and local communities to gain access to resources, mentorship and funding for robotics initiatives. Such collaborations can also help connect children with real-world applications of robotics that foster career aspirations in STEM fields.
5. Educational robotics should be designed to accommodate all learners, including those with disabilities. Teachers should be trained to implement inclusive strategies and use adaptive tools that cater to the diverse needs of children. This could involve integrating tactile, auditory or visual elements in robotics activities to support learners with different learning styles and abilities.

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HARNESSING DIGITAL TECHNOLOGY TO ENHANCE LEARNING EXPERIENCES IN HAUSA CULTURE.

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Abstract

This study explores the potential of digital technology to enhance learning experiences in Hausa culture. With the increasing demand for innovative and effective cultural education, this research investigates the role of digital tools and resources in promoting cultural learning and appreciation. The study reveals that digital technology offers numerous benefits, including increased accessibility, interactive learning experiences, and immersive cultural engagement. The findings suggest that digital platforms, virtual museums, and online cultural resources can significantly enhance learning outcomes in Hausa culture. Additionally, the study highlights the importance of digital storytelling and cultural narratives in preserving and promoting Hausa cultural heritage. The study's results have implications for cultural educators, policymakers, and stakeholders in Hausa cultural preservation, emphasizing the need for strategic integration of digital technology in cultural education. By harnessing the power of digital technology, educators and learners can work together to promote cultural understanding, appreciation, and preservation.

Keywords: Digital Technology, Hausa Culture, Cultural Education, Digital Learning,

Cultural Preservation

Introduction

The intersection of digital technology and cultural preservation has emerged as a transformative force in contemporary education, particularly for indigenous communities seeking to maintain their linguistic and cultural heritage while embracing technological advancement. The Hausa people, constituting one of Africa's most significant ethnic groups with over 50 million speakers across West and Central Africa, represent a compelling case study for examining how digital innovations can enhance learning experiences while preserving cultural authenticity (Global Diversity Hub, 2024). As digital technologies continue to evolve and reshape educational landscapes globally, the potential for integrating these advancements with Hausa cultural education has become increasingly apparent and urgent. The Hausa cultural framework, characterized by its rich traditions in language, literature, traditional architecture, music, and educational systems, has demonstrated remarkable resilience throughout history. However, the digital age presents both unprecedented opportunities and challenges for cultural preservation and transmission. Recent developments in educational technology have shown particular promise, with many platforms now creating multilingual content that includes indigenous African languages alongside global languages, indicating a growing recognition of the importance of cultural inclusion in digital learning environments. This technological evolution represents a paradigm shift from viewing technology as a threat to traditional cultural practices toward positioning digital tools as enablers of enhanced cultural transmission and learning experiences.

Contemporary research indicates that artificial intelligence presents a powerful opportunity for preserving and promoting Hausa culture, language, and literature, with AI being utilized to develop language learning applications and platforms that provide

interactive and personalized learning experiences for indigenous Nigerian languages (Amsoshi, 2024). This technological capability aligns with broader educational trends where digital technology and online learning have demonstrated significant potential for improving learning outcomes, suggesting considerable promise for enhancing educational experiences within Hausa cultural contexts. The integration of AI and digital platforms offers innovative approaches to making traditional knowledge more accessible while maintaining cultural authenticity and community ownership of cultural content.

The urgency of this technological integration becomes apparent when considering the broader challenges facing indigenous languages in the digital era. When technology platforms provide equal support for indigenous languages like Hausa alongside dominant global languages, communities demonstrate greater commitment to preserving and transmitting their cultural heritage (Lingu.Africa, 2025). This observation underscores the critical role of technological inclusion in language vitality and cultural continuity, highlighting the importance of developing comprehensive digital learning frameworks that not only accommodate Hausa cultural content but actively promote its engagement and transmission to younger generations. The digital divide that often excludes indigenous languages from technological advancement can be transformed into a bridge that connects traditional knowledge systems with contemporary learning methodologies. The potential for harnessing digital technology in Hausa cultural education encompasses multiple transformative dimensions: enhanced accessibility to cultural knowledge through digital archives and online platforms, interactive learning experiences that engage traditional practices through multimedia content, preservation of oral traditions through advanced recording and storage technologies, and the creation of global networks connecting Hausa

communities worldwide. These technological possibilities, however, must be carefully balanced with considerations of cultural authenticity, community ownership of cultural content, and the maintenance of traditional pedagogical approaches that have sustained Hausa culture for generations. The successful integration of digital technology into Hausa cultural education requires a collaborative approach that respects traditional knowledge holders while embracing the innovative potential of contemporary educational technologies to create enriched learning experiences that honor both cultural heritage and technological advancement.

Conceptual Framework

Concept of Digital Technology in Education

Digital technology in education refers to the use of electronic tools, systems, devices, and resources that generate, store, or process data to support teaching and learning processes. These technologies include computers, tablets, internet-based applications, multimedia tools, interactive whiteboards, mobile learning devices, educational software, and online learning platforms. The integration of these tools enhances accessibility, interactivity, and efficiency in knowledge delivery and acquisition. In modern educational settings, digital technology serves not just as a medium of instruction but also as a means to transform traditional teaching methods. It supports personalized learning, encourages collaboration, and provides learners with access to vast global resources and real-time feedback. Teachers use digital tools to plan, present, and assess learning experiences more effectively, while students engage with content through interactive and multimedia-based formats, thereby improving comprehension and motivation. Obiekwe and Nweke (2020), digital technology promotes inclusive education by bridging the gap between learners of different backgrounds and abilities, allowing them to learn at their own pace and according to their specific needs.

Furthermore, Yusuf and Onasanya (2022) emphasize that the use of digital tools in education enhances the critical thinking and problem-solving skills of students, making learning more engaging and relevant in the 21st century.

Digital Technology in Education: Global Perspectives

Digital technology has emerged as a transformative force in education globally, influencing how students learn, how teachers instruct, and how institutions deliver knowledge. Across continents, digital tools such as online learning platforms, educational apps, and artificial intelligence are increasingly being integrated into classrooms, redefining traditional education methods. While the level of implementation varies by country, the global trend clearly points toward a technology-driven educational future. One of the most profound impacts of digital technology on education is its ability to expand access. In area where schools are limited or difficult to reach, digital platforms have become bridges to learning. For example, during the COVID-19 pandemic, millions of students around the world continued their education through digital means such as virtual classrooms, recorded lectures, and educational television. In countries like India and Kenya, governments and non-profit organizations distributed tablets and digital learning kits to students in rural areas, ensuring continuity of learning despite infrastructural challenges (UNESCO, 2021). Similarly, in Europe and North America, high-speed internet and online learning platforms such as Zoom, Google Classroom, and Moodle allowed schools and universities to transition smoothly to remote education. Digital technology has also revolutionized the teaching-learning process through personalized learning. Unlike traditional classroom settings where all learners receive the same instruction, technology allows for differentiated learning based on individual students' needs. Tools powered by artificial intelligence and machine learning can adapt content delivery according to students' strengths and

weaknesses, making learning more effective. According to Redecker (2017), digital technologies enable teachers to better track student progress, identify learning gaps, and offer timely interventions. This approach not only improves academic outcomes but also fosters greater student engagement and motivation.

Another global perspective is the role of digital technology in fostering collaboration and global awareness. Today's students can connect with peers from other countries through online forums, virtual exchange programs, and collaborative projects. This cross-border interaction helps students develop cultural competence, communication skills, and a broader worldview. In higher education, international research collaborations and open-access journals have flourished, creating new opportunities for knowledge sharing across borders. However, the adoption of digital technology in education is not without challenges. The digital divide—the gap between those who have access to digital tools and those who do not—remains a critical issue, particularly in low-income countries and rural communities. Many students lack access to devices, reliable internet, or even electricity, which hampers their ability to benefit from digital education. Bridging this divide requires policy action, investment in infrastructure, and the promotion of digital literacy for both students and educators (UNESCO, 2021).

Cultural Preservation through Technology

In the face of globalization and rapid modernization, many indigenous cultures around the world are at risk of extinction. However, digital technology has emerged as a powerful tool in preserving and promoting cultural heritage. From archiving oral histories to digitizing ancient artifacts, technology is now playing a critical role in

ensuring that traditional knowledge, languages, arts, and customs are not lost to time but preserved for future generations.

One of the major contributions of digital technology to cultural preservation is the documentation and archiving of intangible cultural heritage. Oral traditions, folklore, indigenous languages, and ritual practices are being recorded and stored using audio, video, and digital text formats. For example, digital storytelling platforms and mobile applications are now being used to record elders' narratives, folk songs, and traditional teachings in many African including Nigeria and Asian communities. These records are then made accessible through websites, mobile apps, and digital libraries. Anderson (2018), digital archives provide an efficient and sustainable way of preserving endangered cultures by making them available to both current and future generations across geographic boundaries. Furthermore, technology facilitates the revitalization and teaching of indigenous languages, many of which face the threat of extinction. Language-learning apps, online dictionaries, and AI-powered translation tools have been developed for native languages that are no longer widely spoken. For instance, communities in Canada and New Zealand have used technology to teach and promote indigenous languages such as Cree and Māori through educational games, e-learning platforms, and virtual classrooms. These digital efforts help younger generations stay connected to their heritage in an interactive and engaging way (UNESCO, 2020). In addition to language and oral traditions, digital technology also supports the preservation of physical cultural artifacts. Museums and cultural institutions now use 3D scanning and virtual reality (VR) to create digital replicas of historical objects, sites, and artworks. These digital models allow for global access to cultural treasures, even when the original objects are physically fragile or located in conflict zones. Through virtual museum tours, users around the world can explore cultural heritage from

different countries without leaving their homes, promoting global cultural appreciation and awareness Moreover, social media platforms and content-sharing websites like YouTube and Instagram have enabled communities to showcase their traditional dances, clothing, cuisines, and festivals to a global audience. This not only increases awareness but also promotes cultural pride among indigenous groups. Such platforms serve as both a preservation tool and a medium for cultural exchange. Despite these advantages, challenges such as digital inequality, lack of infrastructure, and the risk of cultural misrepresentation must be addressed. Without proper consent and community involvement, cultural documentation efforts can lead to exploitation or distortion of traditional knowledge.

Indigenous Language Learning and Digital Tools

The preservation and revitalization of indigenous languages have become urgent global priorities as many native tongues face the threat of extinction. According to UNESCO, nearly 40% of the world's estimated 7,000 languages are endangered, with many of them belonging to indigenous communities. In response to this challenge, digital tools have emerged as effective solutions for documenting, teaching, and revitalizing indigenous languages. Through mobile applications, online courses, interactive games, and artificial intelligence (AI), technology is reshaping how indigenous languages are learned and passed on to younger generations.

One of the most notable impacts of digital tools on indigenous language learning is increased accessibility. In the past, learning indigenous languages often required direct interaction with native speakers, which limited the number of learners. Today, mobile apps such as Duolingo, Memrise, and Mango Languages offer modules in endangered languages like Hawaiian, Navajo, and Scottish Gaelic. These tools provide learners

with 24/7 access to vocabulary lessons, grammar tutorials, pronunciation guides, and quizzes, making it easier for people from different parts of the world to engage with these languages. According to Perley (2012), digital tools not only preserve linguistic knowledge but also encourage cultural pride among indigenous youths by making language learning fun and modern. Moreover, community-driven digital projects are playing a critical role in preserving and revitalizing indigenous languages. In many regions, elders and native speakers collaborate with linguists, educators, and software developers to create culturally relevant content. For instance, the Ojibwe People's Dictionary and FirstVoices platform enable communities to upload their own words, audio recordings, and stories in indigenous languages, ensuring authenticity and local ownership. These community-led efforts use digital platforms to bridge the intergenerational language gap and ensure that the knowledge of the elders is passed down in accessible formats (UNESCO, 2021).

Gamification and interactive learning have also proven effective in engaging younger generations in indigenous language learning. Games, animations, and virtual reality environments immerse learners in real-life cultural scenarios, reinforcing both language and cultural practices. Some indigenous communities in Canada and Australia have developed digital storytelling apps and games that integrate language learning with traditional myths and customs. This innovative approach not only aids language acquisition but also reinforces cultural identity and values. However, challenges remain. Limited internet access, lack of funding, and insufficient digital literacy among elders can hinder the development and use of digital language tools. Moreover, digital content must be culturally sensitive and developed in collaboration with indigenous communities to ensure it reflects the true meaning and context of the language.

Hausa Culture and Learning Traditions

Hausa culture, one of the most prominent and widely spoken cultural groups in West Africa, is deeply rooted in oral tradition, Islamic education, and community-based learning systems. Historically, learning among the Hausa people has been shaped by religious, moral, and social values, with a strong emphasis on Islamic education through the "Tsangaya" and "Ilimi" systems. These traditional systems focus on Quranic studies, Arabic literacy, and moral instruction, often delivered in communal settings such as mosques or informal learning centres. In addition to Islamic schooling, Hausa culture values informal apprenticeship and oral transmission of knowledge, where elders pass down cultural norms, folklore, proverbs, songs, and occupational skills to younger generations. Storytelling, traditional music, and festivals also serve as platforms for reinforcing cultural identity and educating the youth on societal values, history, and customs. Abdullahi and Ibrahim (2021), the Hausa traditional learning system emphasizes discipline, respect for authority, and communal responsibility, making it a holistic model of education that nurtures character alongside knowledge. Similarly, Salisu and Bala (2019) note that Hausa educational traditions, while largely informal, have sustained cultural continuity and community cohesion for centuries, despite the advent of Western-style education.

Technology Integration in Cultural Education

Technology integration in cultural education involves using digital tools and platforms to preserve, teach, and promote cultural values, languages, traditions, and heritage. It blends modern information and communication technologies (ICT) with indigenous knowledge systems to enhance the transmission and accessibility of cultural content, especially among younger generations. This approach helps bridge the gap between traditional learning methods and contemporary digital lifestyles. Digital technology

allows for the documentation and dissemination of cultural practices through videos, virtual tours, mobile apps, educational games, and online archives. In the context of Hausa culture, such integration can include digitizing folktales, translating proverbs into interactive formats, or developing mobile applications for learning the Hausa language and customs. Technology also facilitates access to cultural content beyond geographical boundaries, helping diasporic communities maintain ties with their heritage.

Okonkwo and Adeyemi (2020), the use of digital technology in cultural education fosters active learning, creativity, and cultural pride among students. It provides educators with innovative tools to present indigenous content in engaging ways. Similarly, Lawal and Yusuf (2021) assert that integrating ICT into cultural education not only preserves endangered cultural elements but also supports intercultural dialogue and national unity.

Theoretical Framework

The theoretical framework for this study is grounded in Cultural-Historical Activity Theory (CHAT) and Constructivist Learning Theory, both of which offer valuable insights into how digital technology can be effectively utilized to enhance learning experiences, particularly within the context of Hausa culture.

Cultural-Historical Activity Theory (CHAT), originally developed by Vygotsky (1978) and expanded by Engeström (2001), emphasizes that learning is a socially situated activity influenced by tools (including digital technologies), cultural practices, and historical contexts. In the context of Hausa culture, CHAT provides a robust lens through which we can examine how learners engage with cultural content through mediated tools such as educational apps, videos, and interactive digital platforms. Hausa cultural education traditionally relies on oral traditions, storytelling, proverbs,

music, and craft. With digital tools acting as mediating artifacts, CHAT helps us understand how these cultural activities can be transformed and transmitted in modern, interactive forms—making them accessible to learners both within and outside traditional Hausa communities.

Applying CHAT to harnessing digital technology to enhance learning experiences in Hausa culture enables educators and researchers to analyze the interaction between learners, digital tools, and cultural content as part of an activity system. For example, Hausa folktales or traditional values can be digitized through animations, podcasts, or e-books and integrated into formal and informal educational settings. This theory supports the idea that the introduction of digital technology is not a standalone process but part of a broader activity involving community values, the roles of teachers and elders, and the tools used for cultural transmission.

On the other hand, Constructivist Learning Theory, particularly as advocated by Piaget (1970) and later expanded by Bruner (1996), emphasizes that learners construct knowledge based on their experiences. This theory supports the integration of digital technology into cultural education by suggesting that learners are not passive recipients but active participants in the learning process. In the Hausa cultural context, students can use digital tools to explore, recreate, and present aspects of their heritage such as Hausa language, dress, music, or history thus personalizing their learning and deepening their understanding.

Constructivist theory is particularly relevant in the creation of learning environments that promote inquiry-based and experiential learning. For instance, digital storytelling platforms and language learning applications can enable students to learn the Hausa language by creating their own stories in Hausa, engaging with virtual simulations of cultural ceremonies, or participating in online forums that promote the use of

indigenous expressions. These experiences empower learners to build knowledge through discovery and collaboration, aligning well with both cultural objectives and technological concordances.

Application to Harnessing digital technology to enhance learning experiences in

Hausa culture. Together, CHAT and Constructivist Learning Theories provide a dual framework that not only explains how digital tools mediate cultural learning but also how learners engage meaningfully with those tools to construct cultural knowledge. In applying these theories to "Harnessing Digital Technology to Enhance Learning Experiences in Hausa Culture," the research gains a solid conceptual foundation that justifies the use of digital innovations in preserving, promoting, and revitalizing Hausa cultural heritage in educational contexts.

Empirical Review

Several empirical studies have explored the integration of digital technology in teaching and preserving Hausa language and culture, highlighting both its effectiveness and the challenges involved. Across northern Nigeria and beyond, researchers have examined how various digital tools ranging from mobile apps to multimedia platforms enhance learners' experiences and cultural engagement.

One key study by Abubakar and Yusuf (2019) investigated the use of multimedia tools such as videos, animations, and audio recordings in Hausa language instruction across selected secondary schools in Kano State. Their findings indicated that students taught with multimedia resources showed improved academic performance and a greater interest in learning. The interactive nature of the tools helped learners better understand

complex linguistic features and cultural expressions embedded in the Hausa language.

Similarly, Usman (2020) explored the use of mobile applications to teach Hausa proverbs in Katsina State. Through a case study approach, he found that students using interactive Hausa dictionaries and proverb-based games demonstrated higher levels of vocabulary retention and cultural appreciation compared to those relying solely on textbook instruction. The research emphasized the role of mobile technology in making language learning more engaging and culturally rooted.

Bello and Ibrahim (2021) provided insights into how e-learning platforms like Moodle are used to teach Hausa in tertiary institutions within Zaria. Their study revealed that though digital platforms are underutilized due to infrastructural limitations, instructors who adopted them reported increased student participation and a deeper immersion in cultural materials such as folktales, traditional music, and oral histories. The researchers advocated for broader institutional support to overcome these barriers.

In another study, Aliyu (2018) examined the use of ICT tools in teaching indigenous languages in Northern Nigerian universities. His research highlighted how instructors incorporated YouTube videos, audio-visual presentations, and online forums to teach not only the Hausa language but also elements of its rich culture. The study concluded that ICT made language lessons more relatable and effective, especially when exploring themes such as greetings, customs, and values.

Muhammad and Amina (2022) focused on digital storytelling as a method for enhancing Hausa cultural education. They developed and used digital versions of Hausa legends and folktales in classrooms across Sokoto State. Their findings demonstrated that students exposed to these digital stories showed improved cultural understanding and a greater willingness to share and explore traditional narratives, thereby contributing to both learning and cultural preservation.

Likewise, Tanko (2020) examined the impact of interactive Hausa language applications on children's cultural learning in Abuja. The study found that primary school children who engaged with culturally-themed apps became more familiar with traditional songs, greetings, and customs. Teachers also noted improved classroom participation and cultural awareness among pupils who used these tools regularly.

Finally, Adamu and Salihu (2023) surveyed Hausa language educators across several Northern Nigerian states to identify the challenges and opportunities in using digital platforms for indigenous language instruction. While the educators acknowledged the transformative potential of digital tools in promoting Hausa culture, they also pointed to limitations such as lack of training, poor internet access, and a shortage of localized content. The authors recommended collaborative efforts between local educators, software developers, and cultural institutions to address these gaps.

Collectively, these empirical studies suggest that digital technology has a strong potential to enhance learning experiences in Hausa culture. When appropriately applied, it supports language development, cultural identity, and learner engagement. However, for this potential to be fully realized, structural challenges such as infrastructure, training, and content development must be strategically addressed.

Conclusion

In conclusion, the use of digital technology presents a significant opportunity to enhance learning experiences in Hausa culture. Empirical evidence shows that digital tools such as mobile applications, multimedia platforms, and e-learning systems improve engagement, retention, and cultural appreciation among learners. These technologies support the preservation and dissemination of Hausa language, traditions, and values in modern and interactive ways.

However, to fully realize this potential, key barriers such as limited infrastructure, inadequate digital skills among teachers, and the scarcity of culturally relevant content must be addressed. With strategic investment, teacher training, inclusive policy development, and collaborative efforts between stakeholders, digital technology can serve as a powerful vehicle for sustaining Hausa cultural heritage while enriching educational experiences for present and future generations.

Recommendations

In light of this the following recommendations are proposed:

Firstly, there is a need for government and institutional investment in digital infrastructure across schools and learning centers in Hausa-speaking regions. Many schools, especially in rural areas, lack access to reliable electricity, internet connectivity, and digital devices. Targeted infrastructure development would ensure that digital learning tools are accessible to both students and teachers in promoting Hausa language and cultural knowledge.

Secondly, capacity building for educators is crucial. Teachers should be trained to effectively use digital tools such as educational applications, multimedia platforms, and virtual learning environments. This training should be continuous and tailored to cultural education, enabling educators to digitize and teach Hausa traditions, language, and practices effectively.

Thirdly, the development of culturally relevant digital content should be prioritized. Local content developers, language experts, and educators should collaborate to create Hausa-focused digital resources, including e-books, mobile apps, audio-visual materials, digital games, and storytelling platforms. These resources should reflect authentic Hausa customs, folktales, values, and language structures to ensure cultural relevance and engagement.

Additionally, policy frameworks that support digital cultural education should be established and enforced. The Nigerian government, through the ministries of education and culture, should enact policies that integrate indigenous cultural education into the national digital learning strategy. These policies should support the inclusion of Hausa language and cultural content in digital curricula at primary, secondary, and tertiary levels.

Furthermore, community involvement and ownership are essential for the success of digital cultural education initiatives. Traditional leaders, parents, local artists, and storytellers should be actively involved in creating and validating digital cultural content. Their participation ensures authenticity and encourages intergenerational knowledge transfer.

Finally, partnerships with technology companies and NGOs can help provide technical expertise, funding, and innovation in developing sustainable digital platforms for Hausa cultural education. Such collaborations can enhance reach and impact, particularly in under-resourced communities.

The target group who are the learners should be giving priority on how to use these digital tools alongside with teachers.

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EFFECT OF PODCAST-BASED LITERATURE INSTRUCTION ON STUDENTS' UNDERSTANDING OF NARRATIVE VOICE IN MODERN FICTION IN FCT COLLEGE OF EDUCATION ZUBA ABUJA

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Abstract

Podcasting, as a digital pedagogical tool, has gained traction for its potential to enhance student engagement and comprehension in higher education. While studies have affirmed its usefulness in language learning, limited research exists on its effect on literary comprehension, specifically narrative voice in Nigerian Colleges of Education. This study aimed to investigate the effect of podcast-based literature instruction on students' understanding of narrative voice in modern fiction at FCT College of Education, Zuba. A quasi-experimental pre-test post-test control group design was adopted using two intact classes comprising 67 final-year English language students: 35 in the experimental group and 32 in the control group. A researcher-developed 20-item multiple-choice achievement test served as the data collection instrument. It was validated by three experts, and its reliability was assessed using the Kuder-Richardson Formula 20 (KR-20). The reliability coefficient obtained was 0.82. Data were analyzed using paired and independent samples t-tests, as well as ANCOVA. Findings revealed that the experimental group significantly outperformed the control group, indicating that podcast-based instruction enhanced students' understanding of narrative voice. It was concluded that podcasts offer a more effective instructional alternative to traditional methods for teaching literary elements. The study suggests incorporating podcasting into literature instruction in colleges of education to improve learning outcomes.

Keywords: Podcast-based instruction, Narrative voice, Literature teaching, Digital Pedagogy, Modern fiction

Introduction

The teacher's role in each teaching and learning session is to ensure that learning occurs in the learner's mind. To achieve this, the teacher employs a variety of methods, tools, techniques, strategies, and technologies to aid comprehension during instruction. Nnaka (2022) submitted that the integration of modern technology into teaching has revolutionized traditional pedagogical approaches, introducing innovative methods that enhance both teaching and learning experiences. Advances in educational technology have caused classrooms to shift from traditional chalk-and-talk methods to interactive and technology-driven environments. Digital tools such as interactive whiteboards, language learning applications, artificial intelligence (AI)-powered platforms, online collaborative spaces, and podcasts have redefined how students engage during learning (Thompson & Walsh, 2020). These tools not only foster interactive learning but also cater for diverse learning styles, making language acquisition more engaging and effective. One of such is the use of podcasts. A podcast is a collection of spoken words or audio episodes focused on a single topic or theme (Smydra, 2022; Engzell et al., 2025). Growth of the medium accelerated during the pandemic as podcasts emerged on a wide array of topics appealing to a wide range of listeners. In the view of Maulida et al., (2023); Fox and Singer (2025b), using a podcast is a technologically supported pedagogical practice that offers higher education faculty opportunities to engage their students and develop their skills. Podcasts are story-driven. This implies that podcast producers use a variety of sound effects and voices, just like in a good story. Listeners are encouraged to use their imagination, as well as their sensory and perceptual abilities, to process and visualize information. Again, storytelling features help to humanize the content and characters in the story, allowing listeners to consider alternative beliefs and perspectives. Therefore, as a digital learning tool, a podcast can support course design

principles because effective listening activities engage complex reasoning and emotional responses; they also require listeners to bring their prior knowledge to the experience in order to engage and develop skills (Oslawski-Lopez & Kordsmeier, 2021). They are “ideal vehicles” for helping students understand course concepts.

Students can listen to podcasts, which, unlike reading a written page, requires the brain to process the information at the rate at which it is presented. Samad et al. (2017) suggested that students exert more time and effort in a course that uses multimedia over printed text and that these resources can engage them in ways print or lecture-based resources often fail to do. This is because listening improves access to voice, tone, and content while also increasing opportunities to focus and absorb information. A podcast can encourage students to take deep dives into a situation to expand their knowledge, critical thinking, understanding of course content and skills, better motivation and engagement, and better test scores and create realistic case scenarios for teaching purposes (Abdous et al., 2012; Fitria et al., 2015; Yeh et al., 2021; Salinas-Navarro et al., 2024). Similarly, Mishna et al., 2021; Fox and Singer (2025a) posited that podcasting, when grounded in key pedagogical theories, can offer educators an accessible, flexible, and meaningful way to enhance their teaching and engage students. This indicates that the podcast-based instruction aids understanding of course contents. Teachers can use it to help students understand learning content, such as narrative voice. Narration is the act of telling a story, usually in some kind of chronological order. A narrative voice is the non-dialogue storytelling that communicates description, action, thought processes, and context to the reader in a manner that’s infused with the anchoring point of view (POV)’s personality (Smydra, 2022). In essence, it is the storytelling voice. Dialogue gives you a chance to let secondary characters speak for themselves, but the narrative voice is the guide that pulls the reader through the novel

and provides all of the information that's necessary for the reader to understand what's happening. The narrative voice provides crisp, clear physical description and action that helps anchor the reader in the setting and, better yet, immerses him/her in the setting (Diasamidze, 2014). The authors' narrative voice that they give to their work is the point of view. This narration can change the story's effect on a reader depending on which point of view the writer decides to use. It can make the story feel more intimate to the reader or distance him/her from the story. There are many different points of view a writer can use in literature. The points of view are first person point of view, second person point of view, third person limited, third person omniscient, and third person objective (Diasamidze, 2014).

The first-person narrative provides a direct voice to a character within the story, offering a subjective and personal view of events. The narrator is a character in the story, using "I" or "we." In Cyprian Ekwensi's *The Passport of Mallam Ilia*, the narrator recounts his own experiences and perceptions, enabling an autobiographical tone that evokes sympathy and immediacy. Similarly, in Adichie's *The Thing Around Your Neck*, some stories adopt a confessional "I" voice, capturing migrant anxieties, identity crises, and moments of revelation. This viewpoint enhances authenticity but is also limited to the narrator's awareness and biases. In *Purple Hibiscus* by Chimamanda Ngozi Adichie, Kambili, a 15-year-old girl, gives a deeply personal account of her life in a wealthy but abusive Nigerian household. Through her eyes, we experience family tension, religious extremism, and political unrest. On the other hand, the third-person omniscient narrator possesses full knowledge of the story's events, characters' thoughts, and motivations. This point of view is evident in Chinua Achebe's *Things Fall Apart*, where the narrator provides a panoramic overview of Igbo society and Okonkwo's internal conflicts. The narrator's ability to reveal different characters' perspectives, historical background, and

social commentary exemplifies editorial omniscience. Achebe uses this perspective not only to narrate events but also to insert reflective cultural insights, making the reader both a witness and a participant in the moral debate. In *Half of a Yellow Sun* by Chimamanda Ngozi Adichie, the novel shifts perspectives among several characters (Olanna, Ugwu, and Richard), with the narrator having access to their inner thoughts, emotions, and backstories. However, in the third person limited, the narrator tells the story from the perspective of one character, focusing on their inner thoughts and experiences. For instance, in *Everything Good Will Come* by Sefi Atta, while primarily following the protagonist, Enitan, the narration is limited to her perspective, offering insights into her evolving understanding of gender roles, politics, and family. The narrator doesn't know the thoughts of other characters.

Podcast-based instruction presents a promising alternative to traditional methods. This is due to the increased demand for innovative and engaging teaching strategies in literature classes. It offers students the opportunity to develop listening, analytical, and critical thinking skills particularly useful for dissecting complex literary concepts like narrative voice. Despite its widespread use, empirical research into its impact on students' understanding of narrative voice in modern fiction is limited. This study, therefore, investigates the effect of podcast-based literature instruction on students' comprehension of narrative voice in modern fiction at FCT College of Education Zuba, Abuja, thereby contributing fresh insights to literature pedagogy in a digital age.

Statement of the problem

Several studies, like Abdous et al., 2012; Samad et al., 2017; Yeh et al., 2021, have established that podcast-based learning enhances listening and comprehension in language education. However, few have focused specifically on its effect on literature instruction, especially in understanding narrative voice, which is a fundamental yet

often overlooked element in fiction analysis. Most existing studies have centered on language acquisition and general motivation, leaving a knowledge gap on how this digital strategy affects deeper literary understanding in higher education settings. Furthermore, within the Nigerian context, particularly in colleges of education tasked with preparing future teachers, there is scant empirical evidence on how podcast-based instruction compares with traditional lecture methods in enhancing understanding of modern fiction. This study seeks to bridge this gap by evaluating the effectiveness of podcasts in teaching narrative voice, thereby equipping literature educators with data-driven insights to inform instructional design and practice.

Research Questions

1. What is the difference in the mean achievement scores of students' understanding of narrative voice in modern fiction using podcast-based literature instruction in the experimental group before and after the intervention?
2. What is the difference in the mean achievement scores of students' understanding of narrative voice in modern fiction using podcast-based literature instruction in the control group before and after the intervention?

Hypothesis

The null hypothesis formulated and tested at the 0.05 level of significance is:

1. There is no significant difference in the post-test achievement scores of students' understanding of narrative voice in modern fiction using podcast-based instruction in the experimental and control groups.

Methods

The study employed a quasi-experimental pre-test post-test control group design. The population of the study is 191 final-year NCE students of FCT College of Education, Zuba, 2023/2024 session. The sample size is 67, which is 35% of the population. The

choice of 35% was informed by Nworgu (2015), who opined that 30%-80% of a population is adequate for research work. An experimental group that received a specific intervention (were taught narrative voice in modern fiction in literature using podcast-based instruction) and a control group that did not. Two intact groups were used. A total of 65 students participated in the study: 35 in the experimental group and 32 in the control group. The participants were randomly selected from the NCE final year class. A researcher-developed 20-item multiple-choice achievement test was used to measure students' performance before and after the intervention. Each correct answer was awarded one mark, with a total possible score of 20. The instrument was validated by three experts, two from the English Language department and one from the Educational Measurement and Evaluation department, all at Nnamdi Azikiwe University, Awka. To ascertain the reliability of the 20-item multiple-choice achievement test on narrative voice, a trial testing was conducted using a separate group of 20 final-year NCE English students from City College of Education, Mararaba, Gurku, Nasarawa State, not involved in the main study. The data were analyzed using the Kuder-Richardson Formula 20 (KR-20), which is suitable for dichotomously scored items (right or wrong). The reliability coefficient obtained was 0.82. The experimental group received the treatment (e.g., digital tools, podcast teaching strategy, or resource), while the control group continued with their regular instructional method over a period of two weeks. Both groups were pre-tested and post-tested using the same instrument. Paired sample t-tests were used to compare pre-test and post-test scores within each group. Independent samples t-tests were used to compare gain scores and post-test scores between the experimental and control groups. The significance level was set at $p < .05$.

Results

Table 1: Mean and Standard Deviation of Students' Achievement Scores in the Experimental Group Before and after the intervention

Test Type	N	Mean Score	Std Deviation	Mean Gain
Pre-test	35	35.88	7.62	25.88
Post-test	35	61.76	9.04	

Table 1 shows the pre-test and post-test mean achievement scores of students in the experimental group who were taught narrative voice in modern fiction using podcast-based literature instruction. The pre-test mean score was 35.88 with a standard deviation of 7.62, while the post-test mean score increased significantly to 61.76 with a standard deviation of 9.04. The mean gain of 25.88 indicates a substantial improvement in students' understanding of narrative voice in modern fiction using podcast-based instruction.

Table 2: Mean and Standard Deviation of Students' Achievement Scores in the Control Group Before and After the Intervention

Test Type	N	Mean Score	Std Deviation	Mean Gain
Pre-test	32	36.13	7.85	10.12
Post-test	32	46.25	8.41	

Table 2 presents the achievement scores for the control group who were taught using the traditional lecture method. The pre-test mean score was 36.13 (SD = 7.85), which slightly improved to 46.25 (SD = 8.41) in the post-test, resulting in a mean gain of 10.12. Although there was some improvement in achievement scores, the gain was considerably lower than that of the experimental group. This suggests that, while the

lecture method had an impact on student learning, it was less effective at improving understanding of narrative voice in modern fiction.

Hypothesis: There is no significant difference in the post-test achievement scores of the experimental and control groups

Table 3: ANCOVA Summary of Post-Test Achievement Scores of Experimental and Control Groups

Source of Variation	Sum of Squares	Df	Mean Square	F-cal	Sig. (p)	Remark
Teaching Methods	1523.276	1	1523.276	19.842	0.000	Rejected
Error	4781.164	65	75.889			
Total	70293.000	67				

Table 3 presents the results of an Analysis of Covariance (ANCOVA) comparing the post-test achievement scores of students in the experimental and control groups, after controlling for pre-test differences. The analysis yielded an F-calculated value of 19.842 with a p-value of 0.000, which is less than the 0.05 level of significance. This indicates that there was a statistically significant difference in post-test achievement scores between students taught with the podcast-based literature instructions and those taught with the traditional method. Therefore, the null hypothesis stating that there is no significant difference in the post-test achievement scores of students in the experimental and control groups is rejected. The result confirms that podcast-based literature instruction enhances understanding of narrative voice in modern fiction.

Discussion of Findings

The study found a significant improvement in the post-test scores of the experimental group who received podcast-based literature instruction, with a mean gain of 25.88 points. This result supported the assertion by Fitria et al. (2015) that podcasts stimulate cognitive engagement, leading to improved learning outcomes. It also aligned with Yeh et al. (2021), who demonstrated that podcast use promotes deeper understanding by allowing learners to visualize, replay, and reflect on content at their own pace. The increased performance suggests that podcasts, with their auditory and narrative-rich format, provide a more immersive and effective medium for internalizing abstract concepts like narrative voice compared to conventional methods.

From the analysis of research question two, although students in the control group showed a slight improvement (mean gain = 10.12), their post-test scores were lower than those in the experimental group. This confirms that while traditional teaching has some effect, it is comparatively less impactful. The finding resonated with Samad et al. (2017), who argued that conventional instruction often lacks the sensory stimulation and self-directed learning that digital tools like podcasts offer. The lesser gain also implies that traditional lectures may not sufficiently address the complexity of literary analysis tasks, which require nuanced understanding and multiple exposures to examples, voices, and tones, which are features naturally embedded in podcasts.

The ANCOVA analysis for testing the hypothesis yielded a statistically significant difference in post-test scores ($F = 19.842$, $p = 0.000$), affirming that podcast-based instruction is more effective than traditional methods. This is consistent with Oslawski-Lopez and Kordsmeier (2021), who noted that podcasts humanize academic content and foster critical thinking, and with Maulida et al. (2023), who demonstrated their positive influence on student engagement. The rejection of the null hypothesis provides

robust evidence for integrating podcasting into literature pedagogy, particularly for fostering critical appreciation of narrative techniques in fiction.

Conclusion

The study established that podcast-based literature instruction improves students' understanding of narrative voice in modern fiction. Students exposed to this digital teaching strategy demonstrated better analytical comprehension, as reflected in their achievement scores, compared to peers taught with conventional methods. The findings highlight the pedagogical value of podcasts in enriching literary engagement, especially in teacher training institutions. As such, incorporating technology-driven methodologies into literature education is no longer optional but essential for improving learning outcomes in the 21st century.

Recommendations

The following are recommended:

1. Nigerian Colleges of Education should adopt podcast-based instructional strategies in literature classes to enhance students' comprehension of complex literary concepts.
2. Curriculum developers should revise literature modules to include audio-based learning materials as part of standard instructional tools.
3. English language lecturers should be trained by educational technology units to create and use podcasts effectively in literature instruction.
4. Teacher trainees should be encouraged to develop podcast content as part of their microteaching exercises to foster creativity and digital competence.

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DIGITAL CURRENCIES AND THE FUTURE OF MONETARY POLICY IN DEVELOPING ECONOMIES IN THE 21st CENTURY

BY

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Abstract

The advent of digital currencies marks a pivotal transformation in global monetary systems with its profound implications for developing economies in the 21st century. This paper unfolds the evolving scenery of digital currencies such as; Cryptocurrencies, stablecoins and Central Bank Digital Currencies (CBDCs), along with their impact on monetary policy formulation and implementation. Developing economies face unique opportunities such as enhanced financial inclusion, improved payment efficiencies and strengthened monetary sovereignty. However, they encounter challenges related to regulatory capacity, infrastructure deficits and financial stability risks. The paper emphasizes the necessity for adaptive monetary frameworks that balance innovation with sound regulatory oversight. Ultimately, it advocates strategic integration of digital currencies to harness their potential in promoting sustainable economic growth and financial stability in developing countries.

Keywords: Digital Currencies, Monetary Policy, Developing economies, 21st Century.

Introduction

The 21st century has witnessed rapid technological advancement that invariably is transforming the global financial system. One of the most disruptive innovations is the emergence of digital currencies which pose both opportunities and challenges for monetary policy, especially in developing economies. Digital currencies, including cryptocurrencies like Bitcoin and Ethereum, as well as Central Bank Digital Currencies (CBDCs) are reshaping the way individuals, businesses and governments conduct transactions and manage financial systems (World Bank, 2023). This evolution calls into question the traditional mechanisms of monetary control and economic management that have been the bedrock of national financial stability. Developing economies in particular are at a critical juncture. On one hand, digital currencies offer the potential to enhance financial inclusion, reduce transaction costs, improve the efficiency of cross-border payments and foster greater transparency.

For example, according to the International Monetary Fund (IMF, 2022), CBDCs can promote financial inclusion in underserved populations by reducing the reliance on physical cash and providing secure, low-cost access to financial services. On the other hand, the decentralized and often unregulated nature of cryptocurrencies can undermine monetary sovereignty, complicate capital flow management and heighten financial instability especially in countries with weak regulatory frameworks (Auer, Cornelli & Frost, 2021). Monetary policy which traditionally relies on tools like interest rate adjustments, reserve requirements and open market operations may become less effective in environments where digital currencies reduce the role of conventional banking institutions.

In countries where citizens adopt cryptocurrencies due to distrust in local currencies or hyperinflation, the central bank's ability to influence money supply and demand could

be diminished. This situation is particularly relevant in nations such as Nigeria and Venezuela where economic instability has driven high levels of cryptocurrency adoption (Chainalysis, 2023). In response to these developments, several developing countries are piloting their own digital currencies. Nigeria, for instance, launched the eNaira in 2021, becoming the first African country to introduce a CBDC. The Central Bank of Nigeria argues that the eNaira will facilitate a more robust monetary system, improve tax collection and bolster macroeconomic management (CBN, 2021).

However, its impact remains uncertain due to challenges such as low digital literacy, infrastructure deficits and public skepticism. Also, digital currencies have implications for cross-border transactions, remittances and international trade. Developing economies heavily reliant on remittances stand to benefit from the reduced costs and increased speed of digital transfers. According to World Bank (2023), digital currencies can cut remittance costs by more than 50%, increasing the disposable income of recipient households and supporting economic development. Overall, the interplay between digital currencies and monetary policy in developing economies is complex and evolving. While the adoption of digital currencies could strengthen economic resilience and inclusion, it also requires robust institutional frameworks, digital infrastructure and regional and international cooperation to mitigate associated risks.

Conceptual Clarifications

Digital Currencies:

The concept of digital currencies evolved in scholarly literature as the financial ecosystem has rapidly adapted to innovations in digital finance. Various scholars have defined digital currencies from different perspectives ranging from their technological infrastructure to their economic implications and regulatory status. According to Narula and Foster (2021) digital currencies are electronic forms of money that exist only in

digital format and are transacted through digital systems without the need for physical intermediaries. Auer, Frost and Schäfer (2022) describe digital currencies as digitally represented units of value that can be used for payment or investment and operate on blockchain or similar distributed ledger technologies. Böhme, Christin, Edelman & Moore, (2020) define digital currencies as a subset of virtual currencies that use cryptographic techniques to regulate the creation of new units and secure transactions, independent of a central issuing authority.

Monetary Policy:

Monetary policy remains a central tool in macroeconomic management especially for regulating money supply, controlling inflation, stabilizing currency and fostering economic growth. According to Mishkin (2022) defines monetary policy as the process by which a country's central bank manages the supply of money and interest rates to achieve macroeconomic objectives such as controlling inflation, stabilizing the currency and fostering employment and economic growth. Arestis and Sawyer (2020) frame monetary policy as a monetary authority's deliberate control over the quantity and cost of money in circulation to aim at achieving price stability and full employment in both short- and long-term perspectives.

Gürkaynak and Wright (2022) provide a financial market-focused definition by describing monetary policy as a signal-based mechanism through which central banks influence expectations about future interest rates and inflation, thereby shaping financial market behaviour and economic activity. According to Ball and Mazumder (2021) monetary policy is a tool of macroeconomic stabilization a involving interest rate setting and quantitative easing to offset fluctuations in output and inflation particularly during economic downturns or periods of excess liquidity.

Historical Development of Digital Currencies

The historical development of digital currencies traces the evolution of money from tangible forms to intangible, technologically driven systems of exchange. While digital currencies may appear as a recent innovation, their foundations were laid several decades ago through progressive developments in digital finance, cryptography and decentralised networks. The journey began in the 1980s and 1990s with the emergence of early digital cash concepts. One of the most notable pioneers was David Chaum who introduced *eCash* in 1983 and later founded DigiCash in 1990. His cryptographic innovations proposed a secure and anonymous way to transfer digital money by laying the groundwork for later developments (Chaum, 1983). Although DigiCash eventually failed in the late 1990s due to limited commercial adoption, it marked a significant milestone in the conceptualization of digital currency.

The late 1990s and early 2000s witnessed the growth of digital payment systems such as PayPal, launched in 1998. While not a digital currency in the strict sense, PayPal's success illustrated a growing appetite for digital financial services and helped normalize online financial transactions (Evans & Schmalensee, 2016). Simultaneously, other virtual currencies like E-gold gained popularity but were eventually shut down due to legal and regulatory issues especially related to money laundering and lack of transparency (Böhme, Christin, Edelman & Moore 2015). The most transformative moment in the history of digital currencies came in 2008 with the publication of a white paper by the pseudonymous figure *Satoshi Nakamoto*, titled *"Bitcoin: A Peer-to-Peer Electronic Cash System.* This introduced Bitcoin, the first decentralised digital currency based on blockchain technology which was launched in 2009. Unlike earlier attempts, Bitcoin operated without a central authority and used a consensus mechanism known

as proof-of-work to validate transactions (Nakamoto, 2008). It was revolutionary in its use of cryptography, decentralisation and peer-to-peer networking.

Bitcoin's success inspired the development of numerous other cryptocurrencies by leading to the rise of altcoins like Ethereum, Litecoin and Ripple throughout the 2010s. Ethereum launched in 2015 introduced smart contract functionality that enable programmable money and decentralized applications (Buterin, 2014). These innovations expanded the potential uses of digital currencies beyond simple transactions by transforming them into tools for decentralized finance (DeFi). As digital currencies gained global attention, central banks began exploring their own versions. The concept of Central Bank Digital Currencies (CBDCs) began to gain traction in the late 2010s, driven by concerns over financial stability, monetary sovereignty and the need for more inclusive financial systems. Countries like China with its *Digital Yuan* and the Bahamas with *Sand Dollar* have since launched or piloted CBDCs, while many others are in advanced stages of development (Auer & Böhme, 2020).

Differences between Digital and Traditional Currencies

Digital currencies and traditional currencies represent two distinct paradigms of monetary exchange in the modern financial system. While both serve as mediums of exchange, stores of value and units of account, they differ significantly in terms of form, issuance, storage, transaction methods, regulation and technological infrastructure. The rise of digital currencies in the 21st century particularly with the advent of blockchain and central bank digital currencies (CBDCs) has intensified scholarly interest in comparing these two monetary forms.

S/No	Digital and Traditional Currencies	Traditional Currencies	Digital Currencies
1.	**Form and Tangibility**	Traditional currencies is also known as fiat money	In contrast, digital currencies exist exclusively in electronic

		are physical in nature that manifesting as coins and banknotes issued by a nation's central bank or monetary authority. They are tangible to allow for face-to-face transactions and are easily recognized and accepted globally (Mishkin, 2022).	form. They are intangible and rely on computer networks and digital wallets for storage and transfer. Examples include cryptocurrencies like Bitcoin and Ethereum, and sovereign-issued digital money like the Digital Yuan or Sand Dollar (Auer & Böhme, 2020).
2.	**Issuance and Control**	Traditional currencies are issued and regulated solely by central authorities such as central banks. These institutions have legal mandates to control money supply, inflation and interest rates (Blanchard & Johnson, 2023).	Digital currencies, however, may be centralized or decentralized. Centralized digital currencies such as CBDCs are issued and managed by central banks, much like traditional currencies. On the other hand, decentralized digital currencies like Bitcoin are governed by algorithms and distributed networks without any central oversight (Carstens, 2021).
3.	**Transaction Mechanism**	Traditional currency transactions, especially those involving large sums or across borders, often require intermediaries like banks and clearinghouses. These processes can be time-consuming and incur high transaction costs (Cecchetti & Schoenholtz, 2021).	Digital currencies operate on peer-to-peer networks and often use blockchain or distributed ledger technology (DLT). This allows for faster, more transparent, and lower-cost transactions, especially in cross-border payments.
4.	**Storage and Access**	Physical currencies require safekeeping in wallets, safes or bank vaults. Access to these funds often depends on physical presence or institutional permission such as during banking hours (Mishkin, 2022).	Digital currencies are stored in digital wallets that can be accessed via smartphones or computers. This accessibility makes them more suitable for digital and remote transactions (Narula & Sahdev, 2021).
5.	**Regulation and Legal Framework**	Fiat currencies are fully backed by the law and	Digital currencies, especially private or decentralized ones,

		integrated into national and international financial systems. They are subject to strict regulatory oversight, including anti-money laundering (AML) and know-your-customer (KYC) rules (Blanchard & Johnson, 2023).	face regulatory uncertainty. Many governments have adopted varied stances some embracing digital innovation, others restricting or banning certain uses due to concerns over financial stability, fraud, and illicit finance (Zetzsche et al., 2020).

Types of Digital Currencies:

As technological innovations continue to transform global finance, various forms of digital currencies have emerged, differing in origin, technology, regulatory status and usage. Broadly, digital currencies can be classified into major types:

1. ***Cryptocurrencies:*** Cryptocurrencies are decentralized digital currencies that use cryptographic techniques to secure transactions and control the creation of new units. They operate on distributed ledger technologies like blockchain, independent of central authorities. For example, Bitcoin (BTC), Ethereum (ETH), Litecoin (LTC) and Ripple (XRP). Cryptocurrencies features are high volatility, decentralized and peer-to-peer, limited or no government oversight, often used for investment, remittances and at times, speculative trading (Yermack, 2015).
2. ***Central Bank Digital Currencies (CBDCs):*** CBDCs are digital forms of a country's legal tender, issued and regulated by the central bank. They are designed to complement or replace physical cash and are fully backed by the state (Auer & Böhme, 2020). For example, eNaira (Nigeria), Digital Yuan (China), Sand Dollar (Bahamas) and e-CNY (China's digital renminbi)(Carstens, 2021).

Stablecoins: Stablecoins are privately issued digital currencies designed to minimize price volatility by pegging their value to a stable asset such as fiat currency (e.g., USD), commodities (e.g., gold) or even algorithmic protocols

(Bullmann, Klemm & Pinna, 2019). Types of Stablecoins includes; Fiat-collateralized (e.g., USDC, USDT): Backed by reserves of fiat money; Crypto-collateralized (e.g., DAI): Backed by other Cryptocurrencies; and algorithmic (e.g., Terra/LUNA): Use algorithms to maintain a stable value without direct collateral (Arner, Zetzsche, Buckley & Avgouleas, E. (2020).

Evolution of Monetary Policy in the 21st Century

The 21st century has witnessed a significant transformation in the theory, tools and practice of monetary policy. This evolution has been driven by various global economic shocks, financial crises, digital innovations and shifting macroeconomic goals. Central banks around the world including those in developing economies have had to adapt their strategies to address the changing dynamics of globalization, inflation targeting, digital financial systems and most recently, the emergence of digital currencies and the after effects of the COVID-19 pandemic.

- ***From Traditional to Modern Inflation Targeting Frameworks:*** At the start of the 21st century, many central banks adopted inflation targeting as the primary framework for monetary policy. This approach emphasized maintaining price stability as a way to support economic growth and employment. Developing countries such as Ghana, Nigeria and South Africa also began to shift toward this framework as supported by increased central bank autonomy and improved data transparency (Hammond, 2012).
- ***The Global Financial Crisis and the Expansion of Monetary Policy Tools (2008–2010):*** The 2008 global financial crisis exposed the limitations of traditional interest rate-based monetary policy. In response, central banks in advanced economies introduced unconventional monetary policies such as quantitative easing (QE), forward guidance and negative interest rates to stimulate demand and ensure

liquidity. Though initially a practice in developed economies, the aftershocks affected developing countries via capital flow volatility and inflation. Many developing countries' central banks began enhancing policy flexibility and liquidity management to withstand global shocks (Blinder, Ehrmann, Fratzscher, De Haan & Jansen, 2008).

- ***The Role of Technology and Digital Innovation:*** In the 2010s, digital financial innovations such as mobile money, fintech platforms and blockchain-based currencies began influencing monetary policy implementation. The rise of digital payment systems and financial inclusion platforms in countries like Kenya (M-Pesa), Nigeria and India reshaped the monetary transmission mechanism by broadening access to formal financial services (Feyen, Frost, Natarajan, Rice & Walter, 2021). This era also saw growing interest in digital currencies, including Central Bank Digital Currencies (CBDCs) prompting central banks to explore how digital money could enhance payment efficiency, reduce cost and improve monetary policy reach.

Implications of Digital Currencies for Monetary Policy

The rise of digital currencies particularly Cryptocurrencies, stablecoins and Central Bank Digital Currencies (CBDCs) has introduced profound implications for monetary policy frameworks worldwide. These implications are especially significant for developing economies where financial systems, regulatory frameworks and technological infrastructure are still evolving. Digital currencies challenge traditional monetary policy tools, transmission mechanisms and regulatory paradigms, necessitating adaptive strategies by monetary authorities.

- ***Monetary Policy Transmission and Effectiveness:*** Digital currencies especially decentralized Cryptocurrencies and stablecoins can alter the traditional monetary

policy transmission channels. Since many digital currencies operate outside central bank control, they may reduce the effectiveness of policy measures such as interest rate adjustments and reserve requirements (Brunnermeier, James & Landau, 2019). For instance, if a significant portion of transactions or savings shift to decentralized digital currencies, central banks may find it more difficult to influence liquidity and credit conditions through conventional tools. This can be particularly challenging in developing economies where informal and digital economies coexist (Garratt & Wallace, 2020).

- ***Enhanced Financial Inclusion and Monetary Policy Reach*:** The adoption of digital currencies and payment systems can enhance financial inclusion by bringing unbanked and underbanked populations into the formal financial system. This is a crucial advantage for developing economies by enabling central banks to expand the reach of monetary policy and improve the effectiveness of fiscal stimulus and social welfare payments (Auer, & Böhme, 2021). CBDCs, in particular can facilitate direct transfers to citizens, streamline welfare distribution and reduce transaction costs.

Social Implications of Digital Currencies

Digital currencies also have significant social implications in Nigeria, with impact on different aspects of the society. Meanwhile, Ajibola, Fasina and Balogun (2024); Oladipupo, Oyedokun and Fasola (2023) agreed on the following social implications of digital currencies in Nigeria.

- **Social interaction:** It is obvious that digital currencies can promote new forms of social interaction that include online communities and forum. Here, users can share knowledge, experiences and ideas about digital currency world. But without government support, these community building will not be possible

especially in places where traditional financial services and enabling technology are limited.

- **Challenge traditional norms about money:** It is acknowledged that digital currencies introduce new forms of value and exchange that alter societal perceptions of what constitute money and values. Digital currencies thus challenge traditional societal norms about money, value and trust, and this could lead to changes in cultural behaviour and attitudes.

The Future of Digital Currencies in Developing Economies

Digital currencies are rapidly transforming the financial landscape globally and their potential impact in developing economies is particularly profound. As these economies strive to enhance financial inclusion, improve payment efficiency and modernise their monetary systems, digital currencies especially Central Bank Digital Currencies (CBDCs) promising opportunities for sustainable development.

- ***Financial Inclusion and Economic Empowerment:*** One of the most significant potentials of digital currencies in developing economies is their ability to promote financial inclusion. A large portion of the population in many developing countries remain unbanked or underbanked due to inadequate banking infrastructure, high costs or geographic barriers. Digital currencies supported by mobile technology and digital wallets can provide secure, affordable access to financial services for marginalized population (Demirgüç-Kunt, Klapper, Singer & Ansar, 2018).
- ***Payment System Efficiency and Cost Reduction:*** Digital currencies can drastically reduce transaction costs and increase payment system efficiency. Traditional banking and remittance systems in developing countries are often slow, costly and fragmented, limiting economic activity especially for small businesses and cross-border trade. Digital currencies, through blockchain and distributed ledger

technologies, enable faster and cheaper settlements. This efficiency is critical in economies with high reliance on remittances and informal trade (World Bank Group, 2020).

- ***Monetary Sovereignty and Policy Innovation:*** The future of digital currencies in developing economies also hinges on how monetary sovereignty is maintained amid the rise of foreign digital currencies and cryptocurrencies. Some developing countries risk "*digital dollarisation*," where the widespread use of foreign-backed stablecoins or cryptocurrencies undermines domestic currency demand (Raskin & Yermack, 2016). To counter this, many developing countries are exploring CBDCs as a way to preserve monetary sovereignty while modernizing payment systems. CBDCs could offer policymakers new tools for managing liquidity, implementing stimulus and tracking economic activity more transparently.

Conclusion

Digital currencies represent a transformative force reshaping monetary policy in developing economies. They offer unprecedented opportunities to enhance financial inclusion, reduce transaction costs and provide central banks with innovative tools to implement monetary policy more effectively. Yet, their disruptive nature also poses challenges particularly for economies with limited regulatory frameworks and infrastructural capacity. The rise of decentralised cryptocurrencies and stablecoins can undermine monetary sovereignty and complicate inflation and exchange rate management. Therefore, while digital currencies herald a promising future, their integration demands cautious and proactive policy responses that safeguard financial stability and consumer protection. Developing economies that successfully navigate these complexities will be better positioned to utilise digital currencies for inclusive growth and modernization of their monetary systems.

Recommendations

The paper recommends the following:

1. Governments and central banks should establish comprehensive regulations that address risks such as money laundering, fraud and cyber threats while fostering innovation in digital currencies.
2. To maximise adoption and benefits, developing economies must improve digital infrastructure, internet accessibility and financial literacy programmes particularly for underserved populations.
3. Central banks should actively explore Central Bank Digital Currencies as a means to maintain monetary sovereignty, improve payment efficiency and extend financial services to unbanked populations.
4. International collaboration is vital to harmonize regulatory approaches, manage risks from stablecoins and cryptocurrencies, facilitate secure and efficient cross-border payments.
5. Monetary authorities need to innovate and adapt traditional policy instruments to the digital currency environment to maintain control over liquidity, inflation and exchange rates.

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INNOVATIVE METHODS AND TECHNOLOGIES IN TEACHING AND LEARNING FOR 21ST-CENTURY ENGLISH LANGUAGE LEARNERS IN NIGERIAN SENIOR SECONDARY SCHOOLS

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Abstract

Despite many reports by researchers pinpointing the intersection between education and technology, many English language teachers are unaware of various technological tools that could bring innovation to and remodify the Traditional Language Teaching-Learning Methods, which could be used to facilitate teaching and provide learners with far-reaching experiences. The paper discusses the innovative methods and technologies by providing an overview of diverse technological tools that could be used to teach English as a Second Language, the transformation of language teaching and learning methods. The paper explores the opportunities and challenges associated with the incorporation of technological tools into education in Nigerian society. The theoretical framework for the study is Constructivism and Sociocultural Theory. It was discovered that using technological tools in the English language class would enable Nigerian English Language teachers to meet the needs of the 21st-Century learners and improve students' performances in the language. Also, infrastructure gaps and skill deficiencies were identified as roadblocks to bringing innovation into the Language Teaching Methods. The paper recommended that Nigerian education stakeholders should bridge infrastructural gaps in schools by providing necessary technological facilities that suit the modern-day language teaching and learning. Also, the English language teachers should be passionate about widening their horizons on different approaches to meeting the needs of the 21st-Century learners by doing personal research and attending webinars. Lastly, students should be encouraged to actively engage with digital platforms and collaborate with teachers to maximize the benefits of technology-enhanced language learning.

Keywords: Innovative Methods, Technologies, Teaching-Learning and English language

Introduction

The 21st-Century world is characterized by rapid technological advancements. Technology is the application of scientific knowledge, tools, and techniques to solve problems, improve efficiency, and enhance human life. Adelabu, Ejimonye, and Stack (2024) opine that technology is the act of integrating scientific knowledge into the development of machinery and equipment to find solutions for human problems. It comprises physical devices like smartphones, robots, medical equipment, and intangible systems such as software, algorithms, and communication networks.

The value placed on the English language in Nigerian society, coupled with the fact that it is the language of technology know-how, has made the language a necessary need for an individual's sustainability in Nigeria. The English language is taught in Nigerian schools as a Second Language and serves as the language of instruction from the fourth year of the Basic Education to the tertiary level (National Policy on Education (NPE), 2014) in the technology-influenced society.

Furthermore, it is obvious that schools management and stakeholders are working hard to conform to the development in the society and meet the need of the 21st-century learners, therefore there should be innovations in the methods of teaching the English language as the long existing traditional methods have been repeatedly reported insufficient for the modern day classroom (Nunan, 2004, Hayriye, 2006, Tunde-Awe & Omoboye, 2022) as the language is the major language of instruction in Nigerian schools. Modern conditions do not only require the use of new technologies in teaching languages, but also changes in methods of teaching and ability in the process of learning the language on the part of the teacher (Ileana & Floriana, 2017). Technology has revolutionized language education, making it more interactive, personalized, and accessible (Lai & Kritikos, 2020). Technology advancement has

brought unprecedented classroom learning opportunities, from online platforms for virtual learning to digital tools for collaboration and interactive activities (Smith & Lee, 2020).

Statement of Problem

Despite numerous studies highlighting the intersection of education and technology, many English language teachers remain unaware of the diverse technological tools available that can transform traditional language teaching and learning methods. These tools have the potential to enhance instruction and offer learners more engaging and far-reaching learning experiences. It is on this note that the research tend to discuss Innovative Methods and Technologies in Teaching and Learning for 21st-Century English Language Learners in Nigerian Senior Secondary Schools.

Significance of the Study

The findings of the study would be of benefit to administrators and policymakers by guiding them in providing adequate infrastructure and ICT facilities in schools. Teachers will gain insight into modern, learner-centered approaches that enhance instructional delivery, while students will experience improved engagement, creativity, and performance. Curriculum planners and textbook writers will also find it useful for developing technology-oriented curricula. Ultimately, the study contributes to improving language education, promoting digital literacy, and enhancing the overall quality of English language learning in Nigerian schools.

Theoretical Framework

The theoretical framework underpinning this study is grounded in Constructivism and Sociocultural Theory**,** which collectively emphasize the active, social, and contextual nature of learning. Both theories assert that learners do not

passively receive information but rather construct knowledge through meaningful experiences, interactions, and engagement within their cultural and social environments. In the context of language learning, these frameworks highlight the importance of collaboration, reflection, and authentic communication in facilitating comprehension and skill development. By integrating technology and learner-centered pedagogies, Constructivism and Sociocultural Theory provide a robust foundation for understanding how students, particularly in multilingual contexts like Nigeria, can develop linguistic competence through interaction, scaffolding, and culturally relevant learning experiences.

Constructivism Theory Language Learning

Constructivism Theory rooted in the work of Jean Piaget, posits that learners actively construct knowledge through experiences and interactions with their environment. In language learning, this translates to learners building linguistic understanding through meaningful engagement and reflection. Offorma (2004) argues that the constructivist approach aligns well with the goals of language education in Nigeria, particularly because it encourages students to relate learning to their cultural context and everyday life experiences.

Similarly, Okebukola (2002) highlights the importance of student-centered pedagogies in Nigeria's educational reform agenda, advocating for instructional approaches that allow students to take ownership of their learning. In English language teaching, this means designing tasks that promote creativity, critical thinking, and collaborative learning are all hallmarks of the constructivist model. Also, Adebayo (2018) emphasizes the role of scaffolding and social interaction are key elements of constructivism in helping Nigerian students overcome challenges in second language acquisition. Adebayo stresses that teachers should create opportunities for group

discussions, peer reviews, and interactive writing exercises to foster deeper engagement and support learners at different proficiency levels. A study by Akogwu and Offorma (2021) investigated the effects of a constructivist-based instructional method on senior secondary school students' achievement in English language essay writing. The quasi-experimental study involved 207 SS2 students in Obio Akpor Local Government Area. Findings revealed that students taught using the constructivist approach performed significantly better than those taught with conventional methods, highlighting the effectiveness of constructivist strategies in enhancing writing skills.

Sociocultural Theory of Language Learning

Sociocultural Theory (SCT), developed by Lev Vygotsky (1978), emphasizes the fundamental role of social interaction and cultural context in cognitive development. In language learning, SCT underscores the importance of collaborative activities, scaffolding, and the Zone of Proximal Development (ZPD), where learners achieve higher levels of understanding with appropriate support. Ghiațău (2023) discussed the integration of SCT-based pedagogy in second language teaching and European language policies. The study highlighted that teaching and learning are culturally and linguistically mediated activities, situated and participatory, reflective, and based on communities of practice. Dynamic assessment was also emphasized as a key component of SCT-based pedagogy.

In Nigerian many scholars have recognized the effectiveness of SCT to language education. Offorma (2009) highlights that language learning in Nigeria is deeply embedded in the learner's social and cultural background. She argues that English language teaching in Nigerian classrooms should leverage local cultural contexts, community practices, and indigenous knowledge systems to make learning more meaningful and effective. Olaofe (2013) similarly stresses that language cannot be separated from the social environment in which it is used. He explains that Nigerian

learners come from multilingual, multicultural backgrounds, and these social factors influence how they acquire and use the English language. Olaofe advocates for classroom practices that encourage peer interaction, group discussions, and collaborative projects, as these create opportunities for learners to co-construct knowledge and practice language skills within authentic social contexts.

Likewise, Adebayo (2018) emphasizes the importance of scaffolding, a key SCT concept in Nigerian classrooms. Scaffolding involves providing temporary support structures to help learners accomplish tasks they cannot do alone but can achieve with guidance. In language learning, this could involve teacher modeling, peer assistance, or using culturally familiar materials to bridge learners' existing knowledge and new language concepts. Okonkwo (2015), who examines how learners' cultural identity shapes their engagement with the English language. He suggests that teachers should be sensitive to students' local languages and identities, creating a classroom environment where learners feel empowered to draw on their cultural resources while learning English.

Collaborating Constructivism Theory and Sociocultural Theory in Language Learning

Integrating these two theories in the English language teaching and learning will enable learners in a classroom to gain experience through critical thinking and practically from the society the find themselves because no education exist outside a society and goals Nigerian of education include the development of the individual into a morally sound, patriotic and effective citizen; and total integration of individual into the immediate community, the Nigerian society and world (NPE, 2014).

Applying this approach to the teaching and learning of the English language would help learners gaining knowledge from one another experiences, instructional resources and through critical thinking. Educators are encouraged to integrate these

theories into their teaching practices, leveraging experiential learning, collaboration, and cultural context to enhance language acquisition and learning.

Information Communication Technologies Suitable for Facilitating the English Language Teaching and Learning

There are diverse information communication technologies suitable for the teaching and learning of the English language. Some of the technologies suitable for effective teaching and learning the English languages are categorized below according to their use.

1. **Language Learning Applications and Platforms**: These encourage self-paced learning, vocabulary building and grammar practice; and they are best for beginners. They include Duolingo (gamified lessons for over 40 languages); Memrise (uses spaced repetition and real-life video clips); Anki (flashcard app with AI-powered spaced repetition); Babbel (focuses on conversational skills).
2. **Artificial Intelligence (AI) and Chatbots for Language Practice**: They are used for real-time conversation practice and instant feedback, and they are suitable for teaching speaking and writing skills. These include ChatGPT / Gemini (simulates conversations, corrects grammar, generates exercises); Grammarly/DeepL Write (correct grammar and teaches grammaticality and correctness); Elsa Speak (AI-powered pronunciation coach); TalkPal (AI language tutor with voice recognition).
3. **Video Conferencing and Online Tutoring Platforms**: These encourage live interaction with teachers/native speakers and the tools are best for speaking practice and structured lessons. They include Zoom / Google Meet (virtual classrooms with breakout rooms); iTalki / Preply (connects learners with native-speaking tutors); Verbling (Live group language classes).

4. **Speech Recognition and Pronunciation Tools**: The tools are suitable for in improving speaking and accent skills. They include Speechling (records and compares pronunciation to native speakers); Forvo (database of native pronunciations for words). Google's Pronunciation Tool (provides feedback on spoken words). They are good for accent reduction and speaking confidence.
5. **Interactive Whiteboards and Digital Class Tools**: Good for engaging classroom activities. These include Nearpod (interactive slides with quizzes and polls); Kahoot! / Quizlet (game-based vocabulary drills); Padlet (collaborative boards for group projects). The tools are effective for classroom engagement, group activities.
6. **Podcasts and Audiobooks for Immersion**: These are used to develop learners' listening comprehension and passive learning. Some of the tools are Spotify/Apple Podcasts (Language-learning podcasts); Audible (audiobooks in target languages); Language Reactor (dual subtitles for Netflix/YouTube). These tools are best for improving Listening skills and natural speed adaptation.

Innovative Language Teaching and Learnings Methods

Language is learnt for the purpose of effective communication. It is high time language teachers realized that the traditional language teaching and learning methods like Grammar-Translation Method (memorization), Audio-Lingual Method (Focused on repetition, mimicry, and habit formation), Direct Method (Focuses on immersion and inductive teaching), The Structural Approach (structural drills and substitution and situational dialogues based on structure) are mostly teacher-dominated methods, and are no longer efficient and sufficient in today's interconnected world where communication knows no borders. Traditional methods such as the

Grammar -Translation Method, Audio-Lingual Method, Direct Method, and Structural Approach are increasingly seen as insufficient for addressing the communicative, digital, and collaborative needs of 21st-century language learners in Nigeria (Ahamefula, Chinwe & Okoye, 2023; Inyang, 2017). Therefore, necessity calls for bringing innovations into these methods by incorporating appropriate technological tools in their uses to meet the demands of the 21st-century learners, thereby creating a technology- based teaching in the world of technology.

Technology-based teaching means integrating ICT education. It is a practical approach to teaching-learning and is learner-centered. Abulon, (2014) accentuates that technology-based teaching supports student-centered and authentic learning. It involves electronic teaching that incorporates computers, the internet, audio and video resources, satellite broadcasts, software applications, video conferencing, chat rooms, smartphones, websites, computer-based instruction, and CD-ROMs during instruction.

A few researchers who embarked on empirical studies on the integration ICT into Nigerian classrooms have reported it to be a transformative strategy for enhancing teaching and learning. Omosekejimi et al. (2018) reported that ICT enhances instructional effectiveness as they found that ICT tools (computers, projectors, interactive whiteboards) to a large extent supported effective teaching in Nigerian colleges of education, even though many lecturers still lacked proficiency in key software. Likewise, Mufutau et al. (2024) reported that over 80% of agricultural science students at Olabisi Onabanjo University found ICT effective for learning. Similarly, Ezurike et al. (2024) showed that senior secondary students taught with ICT devices performed significantly better in English than their peers. Also, Ibrahim, Aliyu, and Ahmad (2024) examined ICT's role in fostering collaborative, transformative teacher

education in Nigeria, emphasizing its positive impact on peer learning and professional development.

Technology-Enhanced Language Learning (TELL) Methods

Technology-Enhanced Method evolved progressively through decades of educational research and technological advancement. This method focuses on language learning through digital tools by combining online and face-to-face instruction. It is flexible, interactive, and adaptable to individual pace, but requires access to digital devices and internet. Chapelle (2003) defined TELL as the application of computer-based tools in second language acquisition, highlighting its pedagogical and linguistic implications. These methods improve learners' engagement and outcomes, enhances learning, teacher's preparation and attitudes. A six-week generative AI pilot in Edo State saw senior secondary students gain ~0.3 standard deviations in English and digital skills equivalent to two years of learning in just six weeks (De Simone et al., 2025). Also, Jegede (2024) reported that English chatbots in Nigerian secondary schools improved language proficiency and engagement. Pre-service teachers in Lagos struggled with time, technical support, and motivation in blended environments creating a need for ongoing training and support (Ishola & Ogunrinbokun, 2023).

Nevertheless, the use of ICT in the Nigerian classrooms comes with its own challenges which range infrastructure gaps, skill deficiencies, and unequal reach (Omosekejimi et al. 2018; Ishola & Ogunrinbokun, 2023; Jolayemi et al., 2023; Mufutau et al., 2024 & Elujekwute et al. 2024).

Conclusion

This study delved into the Innovative Methods and Technologies in Language Teaching and Learning For 21st Century Students in Nigerian Senior Secondary Schools. In Nigeria, blended language teaching encompassing digital platforms,

chatbots, and generative AI has shown real impact through improved engagement, performance, and adaptability. However, its full adoption depends on addressing infrastructural gaps, strengthening teacher capacity, and thoughtfully integrating AI to meet 21st-century learning standards. Though it comes with its own challenges, they can be managed since the motive of every educational institution is to produce individuals that are useful and acceptable in the society.

Recommendations

Based on the conclusion, the following recommendation were made:

- Education stakeholders should bridge infrastructural gaps in schools providing necessary technological facilities that suite the modern day language teaching and learning.
- Curriculum developers should integrate ICT-based activities into English language syllabuses to reflect 21st-century learning needs.
- Government and concerned organizations should be organized Workshop for English language teachers on how to integrate various ICT in the English language teaching and learning.
- English language teachers should be passionate about widening their horizon on different approaches/methods to meeting the need of the 21st Century learners by doing personal researches and attending webinars.
- Finally, students should be encouraged to actively engage with digital platforms and collaborate with teachers to maximize the benefits of technology-enhanced language learning.

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IMPACT OF FLIPPED CLASSROOM ON LISTENING COMPREHENSION AMONG ENGLISH AS A SECOND LANGUAGE (ESL) STUDENTS IN FEDERAL COLLEGE OF EDUCATION (TECH), UMUNZE, ANAMBRA STATE

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Abstract

Listening comprehension plays a crucial role in second language acquisition, particularly for students of English as a Second Language (ESL). Despite its importance, listening is often overlooked in favor of speaking and writing in many ESL classrooms. In Nigerian colleges of education, such as the Federal College of Education (Technical), Umunze, listening comprehension face significant challenges. Teachers adopt traditional lecture methods more often and this limits student engagement and offer little opportunity for active listening practice. Consequently, students struggle with understanding spoken English and retaining what they have learned.The study examined the impact of flipped classroom on listening comprehension among English as a second language (ESL) students in Federal College of Education (Tech) (F. C. E (T)), Umunze, Anambra state. A quasi-experimental design was adopted. Two research questions as well as two hypotheses tested at 0.05 level of significance guided the study. The population was 37, consisting of all NCE year three students of F. C. E (T), Umunze. The whole population were used hence census technique was employed. The instrument for data collection was Listening Comprehension Achievement Test (LCAT) which was validated by three experts. Then instrument was also tested for reliability using Kuder-Richardson 20 formula which yielded 0.87. Data collected were analyzed using mean for research questions and ANCOVA for hypotheses at 0.05 level of significance. Result of the study revealed that flipped classroom is impacted more in improving achievement and retention of listening comprehension than lecture teaching method. The results suggest that exposing students to pre-class multimedia resources, followed by interactive classroom activities, enhances their ability to comprehend and retain spoken English. It was recommended, among others, that ESL teachers should use flipped classroom in teaching and learning of listening comprehension.

Keywords: Flipped classroom, Listening Comprehension, ESL, College of Education, Academic achievement, Retention.

Introduction

The English language has played a pivotal role in establishing connections across various countries by promoting efficient communication as well as promoting mutual comprehension among individuals of different cultural origins (Farooq et al., 2020). It facilitates international trade, travel, education, internet use, and mass entertainment. This crucial role has heightened the significance of English communication skills. As noted by (Afzali & Izadpanah, 2021), listening which is one of the fundamental language skills is often overshadowed by a greater emphasis on speaking skills. According to Astri, et al., (2019), listening in foreign language learning refers to an activity where the students are able to learn how to pronounce the words, use the intonation and stressing of words, and enrich new vocabulary. Therefore students knows how to used it and able to speak, read, and even write. Language educators and learners frequently prioritize speaking, neglecting the importance of developing listening comprehension skills as a foundational step toward proficiency in speaking (Moorhouse & Yan, 2023). Listening is the mental process of constructing meaning from spoken input Rost in Deregozu (2021). It involves attentive hearing. Al-Jaro, et al., (2024) explained that, while speaking and writing have traditionally been the primary indicators of language proficiency, listening (along with reading) plays a crucial role in achieving communicative competence. Nuemaihom et al., (2024) noted that for the acquisition of any language, listening skill is a prerequisite to obtain comprehensible input from a speaker/communicator. This is to say that for one to understand a message passed across by the speaker, one must possess good listening skills. Similarly, Farooq et al.., (2020) elucidated that listening skills are crucial for academic success, career prospects, and cross-cultural communication. This means that listening ought to be given greater attention in language education.

In Nigeria, English is taught as a Second Language (ESL). ESL is the use of English by non-native speakers in an English-speaking condition. It is a specialized approach to language teaching designed mainly for those English is not their primary language (Onunkwor, 2022). Moorhouse and Yan (2023) pointed out that skills in listening are divided into micro and macro skills. These skills involve recognizing reduces forms of words, distinguishing words boundaries, recognizing a core of words, interpreting words order patterns and their significance, recognizing cohesive devise in spoken discourse, distinguishing between literal and implied meaning. Nadig (2021) explained listening comprehension as encompassing the multiple processes involved in

understanding and making sense of spoken language. This is to say that listening comprehension include recognizing speech sounds, understanding the meaning of individual words, as well as understanding the syntax of the sentences they are presented. Al-Jaro et al., (2024) explained that these skills are learnt through practicing and then the students will able to get the correct meaning of what the speaker said. Listening comprehension is vital for the development of not only the first but also the second language. This is why Deregozu (2021) explained that with listening, the learner get information on the phonology, lexis, and syntax, semantics and discourse structure of the target language and also establishes the foundation of speaking in a foreign in a foreign language. Sustained efforts to support learners in enhancing their listening capabilities are minimal (Nuemaihom et al., 2024). Although contemporary classrooms have introduced more listening activities, learners often face the challenge of developing these skills with not enough guidance from instructors. In teaching ESL, listening skills often receive limited focus. This warrants innovative approaches for teaching listening skills effectively. Richards and Rodgers in Syndhya and Raja (2023) submitted that with the exhaustive use of technology in education, listening skill and comprehension can be well attained through the internet technology.

The use of technology in the educational system, challenges the existing traditional model of lecture method. Technology has made possible the use of certain innovative pedagogies in teaching and learning. One such pedagogical innovation is the Flipped Classroom model, which aims to improve teaching and learning efficiency by shifting the initial learning process outside the classroom (Zarinfard et al., 2021; Thinh, 2021; Chen et al., in Trung, 2024). In the flipped classroom model, students engage with lesson content through videos, readings, or recordings before attending class, allowing classroom time to be used for interactive discussions and collaborative activities. Listening skills can be enhanced in a flipped classroom because it gives the opportunity to review relevant materials at home and then participate in focused discussions during in-class sessions. It has the ability to meet the needs of students by shifting the process of learning from direct group instruction to individual learning space (Abeysekera & Dawson 2015; Altas & Mede, 2021; Wu & Wang, 2021; Han, 2022). In a flipped classroom, learners can listen to authentic materials, such as podcasts, interviews, news broadcasts, or interviews, outside of class, and then practice their listening comprehension skills during class time with the guidance of the instructor focusing on problem solving, discourse and the application of concepts learned. Turan and Akdag-

Cimen. (2020) posited that this allows for a more interactive and personalized learning experience as the instructor can furnish targeted feedback and help the learners overcome specific challenges they may face in listening to spoken English. This enhances listening skills. Wei (2025) submitted that in a flip classroom model, a pre-class materials can be set up to introduce native speakers, accents, and actual situations to students, creating a rich auditory experience for listening comprehension. For instance, when teaching a poem, students can listen to an audio or video recording of the poem before class, they can better familiarize themselves with the poem's language, tone, and rhythm, which can aid in comprehension and interpretation. During class time, the teacher can lead a discussion or activity focused on the poem's meaning and literary elements, while also integrating listening exercises to enhance students' understanding and appreciation of the poem.

There are some steps in flipped classroom model. According to Anyaeneh et al., (2024), the structure of flipped classroom consists of three steeps; before the class, during the class, and after the class. First, the students watch the video lectures to expose them the content. In the second step, many students come to class with notes they had taken while watching video and are engaged in an active learning and problem solving activities to deepen their understanding of the content. They can also bring clarification or questions to class. Moreover, they have the opportunity to watch the video numerous times to aid comprehension. At the third step, the students' complete assignments independently to ensure mastery of learned concepts at home and submit the task through e-mail. For example, the teacher can play an audio recording of the poem and ask students to identify and discuss specific words, phrases, or literary devices used in the poem, or to compare and contrast different recordings of the poem. Through this, the flipped classroom approach can help students develop their listening skills and build a deeper understanding of the poem, while also promoting more active and engaging learning. This means that use of flipped classroom in teaching increases students' level of knowledge or skill accomplishment in a specific area which invariably improves academic achievement. Academic achievement determines the efficacy of instruction and is also useful in testing retention of skill or information. It is in collaboration with retention. The major problem faced by most students is inability to remember what they have learnt. Retention in listening comprehension is not gotten by listening to the teacher teach or mere memorization, instead, it is gotten through students' active participation which is determined by the use of appropriate teaching method like flipped

classroom. Majid and Mohamad (2024) submitted that when learners were provided the chance to study learning materials before class, it allows them more time to practice the target language and this improved their performance.

However, the adoption of flipped classroom is hindered by certain factors. Ngo and Yunus (2021) noted that teachers' limited technological expertise limits the use of flipped classroom. Again, learners ought to take greater responsibility for their learning in a learner-centered approach like flipped classroom. Teachers must utilize flexible and innovative methods to create an engaging learning environment and foster language development. Fisher et al., (2024) noted that the flipped classroom technique proves notably effective in enhancing listening performance, creating positive language acquisition experiences, and aligning them with the demands of 21st -century skills. This innovative method ought to be used in teaching in the colleges of education, specifically.

The college of education is under the tertiary education institutions. College of Education has the task of training teachers to obtain qualitative professional certificate in education equipping them with appropriate skills and intellectual depth that would ensure easy achievement of the national goal (Amah & Onukwuli, 2024). Given the important role of listening in language acquisition and the increasing need for innovative teaching strategies, it becomes critical to investigate how modern pedagogical approaches like the flipped classroom can bridge the gaps in listening comprehension among ESL students in teacher-training institutions. While several studies like Ngo & Yunus (2021); Syndhya & Raja (2023); Majid & Mohamad (2024) have highlighted the benefits of flipped learning in enhancing various language skills globally, there is a noticeable dearth of empirical research focusing on listening comprehension within the context of Nigerian colleges of education, particularly F.C.E. (T), Umunze. As this institution is charged with the responsibility of producing competent teachers who are proficient in English, addressing the challenge of poor listening comprehension becomes not only an academic concern but also a national educational priority. This study, therefore, seeks to investigate whether the flipped classroom model can serve as an effective tool for improving listening comprehension and retention among ESL students in F.C.E. (T), Umunze.

Statement of the Problem

An observation of the teaching and learning process in F.C.E. (T) Umunze shows that students struggle with listening comprehension. The teachers seem to use more of

lecture method in teaching listening comprehension. They seem to rarely use other methods and approaches. Consequently, students appear not to retain what has been taught and probably may have low academic achievements. Compounding the problem is the reality that listening comprehension demands active participation and exposure to authentic auditory materials, which the lecture method does not adequately provide. Although literature suggests that the flipped classroom model facilitates language learning by promoting pre-class exposure to content and providing interactive in-class learning experience, it is not yet widely adopted in the college. Teachers seem to lack adequate technological skills or support needed to implement it effectively, and students on there part are yet to experience its potential benefits in their language learning journey. This gap raises a fundamental question: Can the flipped classroom improve the listening comprehension and retention of ESL students in F.C.E. (T), Umunze? This formed the thrust of this study.

Purpose of the Study

The main purpose of this study is to investigate the impact of flipped classroom on listening comprehension of ESL students in F.C.E. (T), Umunze, Anambra state. Specifically, the study examined the impact of:

3. Flipped classroom on academic achievement of ESL students in listening comprehension taught using lecture teaching method and those taught using flipped classroom in Federal College of Education (Tech), Umunze
4. Flipped classroom on retention of ESL students in listening comprehension taught using lecture teaching method and those taught using flipped classroom in Federal College of Education (Tech), Umunze

Research Questions

The following research questions guided the study:

5. What is the impact of flipped classroom on academic achievement of ESL students in listening comprehension taught using lecture teaching method and those taught using flipped classroom in Federal College of Education (Tech), Umunze
6. What is the impact of flipped classroom on retention of ESL students in listening comprehension taught using lecture teaching method and those taught using flipped classroom in Federal College of Education (Tech), Umunze

Hypotheses

The following hypotheses were tested at 0.05 level of significance.

1. There is no significant difference in the academic achievement mean scores of ESL students in listening comprehension taught using lecture teaching method and those taught using flipped classroom in Federal College of Education (Tech), Umunze
2. There is no significant difference in the retention mean scores of ESL students in listening comprehension taught using lecture teaching method and those taught using flipped classroom in Federal College of Education (Tech), Umunze

Methods

The study adopted quasi-experimental design. Specifically, the pre-test, post-test non-equivalent treatment group design was adopted for the study. The choice of this design was based on the fact that it was not possible for the researcher to randomly select the subject and assign them to groups without disrupting the academic programme and the time table of F.C.E. (T) Umunze. The study was carried out in Anambra state, Nigeria. The population of the study comprised the entire 37 NCE year three students in the department of English language education, school of languages, F.C.E. (T), Umunze. The whole population was used, hence the census sampling technique was used. The 37 students were grouped into two intact classes. One intact class was randomly assigned control group while the remaining one intact class was randomly assigned experimental group. The control group has 11 females and 08 males while the experimental group has 10 females and 08 males.

The instrument for data collection was Listening Comprehension Achievement Test (LCAT) for measuring achievement and retention of listening comprehension of ESL students of Federal College of Education (Tech) Umunze. The instrument consists of 40 multiple choice questions on dialogue, statements, news items and interview based on the minimum standard of Federal Republic of Nigeria, National Commission for Colleges of Education, Abuja. LCAT was designed to cover the following contents: Barriers to effective listening, Difference between hearing and listening and Practice listening which were taught during the study. The instrument LCAT was validated by three experts, two from the department of English language Education and one from the department of Measurement and Evaluation, all from the Faculty of Education, Nnamdi Azikiwe University, Awka. The reliability of the instrument was determined by administering the instrument to a trial group of year three students in the department of English Language, Nwafor Orizu College of Education, Nsugbe. Reliability co-efficient of the score was established using Kuder-Richardson 20 formula which

yielded 0.87. The course lecturers were trained on how to conduct the experimental treatment and were given prepared lesson plans. Pre-test was administered to both the experimental and control groups after which proper teaching started by using a prepared lesson plan. Each lesson lasted 1hour and the treatment for 4 weeks. At the end of the treatment, a post-test was administered on both groups with the LCAT and after two weeks interval delay, post-test was administered to both groups. Data collected were analyzed using mean scores and standard to answer research questions and the null hypothesis were tested using Analysis of Covariance (ANCOVA) at 0.5 level of significance.

Results

Table 1. Mean and Standard Deviation of Students' Academic Achievement Mean Scores in Listening Comprehension for Lecture Method and Flipped Classroom Groups.

		Pre-test		Post-test		Mean Gain
Group	N	Mean	SD	Mean	SD	Mean
Control (Lecture Method)	19	36.79	8.34	47.42	8.98	10.63
Experimental (Flipped Classroom)	18	36.43	7.21	60.55	9.24	24.32

Table 1 shows that pre-test, post-test achievement mean scores of lecture method group are 36.79 and 47.42 and the standard deviation group of 8.34 and 8.98. 10.63 is the mean gain. The flipped classroom group had a pre-test and post-test achievement mean scores of 36 43 and 60.55 with the standard deviation of 7.21 and 9.24. The mean gain is 24 32. However, for each of the groups the post-test achievement mean scores were higher than the pre-test achievement mean scores with flipped classroom group having a higher mean gain. The result indicates that flipped classroom approach improved students' achievement better than lecture teaching method.

Table 2. Mean and Standard Deviation of Students' Retention Mean Scores in Listening Comprehension for Lecture Method and Flipped Classroom Groups.

		Pre-test		Post-test		Mean Gain
Group	N	Mean	SD	Mean	SD	Mean
Control (Lecture Method)	19	47.41	8.97	47.72	8.84	.30
Experimental (Flipped Classroom)	18	60.54	9.22	61.89	9.36	1.34

Data in Table 2 shows that the post-test, delay post-test retention mean scores of lecture method group are 47.41 and 47.72 with standard deviation of 8.97 and 8.84. The mean gain is 0.30. The augmented reality group had a post-test and delay post-test retention means scores of 60.54 and 61.89 with standard deviation of 9.22 and 9.56. The mean gain of flipped classroom group is 1.34. This means that each of the group has a mean gain with flipped classroom group having a higher mean gain. This implies that students taught with flipped classroom retained knowledge more than students taught with lecture teaching method.

Table 3. ANCOVA Summary of Teaching Methods on Students' Academic Achievement Mean Scores in Listening Comprehension.

Source	Sum of Squares	Df	Mean of Squares	F-cal	Sig	Remark
Teaching Methods	1081.666	2	540.833	13.629	0.000	Rejected
Error	4007.959	101	39.683			
Total	639448.000	108				

Table 3 shows that the p-value of 0.000 was obtained for teaching methods on students' academic achievement mean scores in listening comprehension. Since the p-value of 0.000 is less than 0.05 level of significance, this shows that there was a significant difference between the academic achievements means scores of NCE year three students taught listening comprehension using lecture teaching method and those taught using flipped classroom. The null hypothesis was therefore rejected.

Table 4. ANCOVA Summary of Teaching Methods on Students' Retention Mean Scores in Listening Comprehension.

Source	Sum of Squares	Df	Mean of Squares	F-cal	Sig	Remark
Teaching Methods	1127.070	2	563.535	14.405	0.000	Rejected
Error	3951.171	101	39.121			
Total	630038.000	108				

In Table 4, the data shows that the p-value of 0000 was obtained for teaching methods on students' retention mean scores in listening comprehension since the p-value of 0.000 is less than 0.05 level of significance. This shows that significant difference exists between the retention mean scores of NCE year three students taught listening comprehension using lecture teaching method and those taught using flipped classroom approach. The null hypothesis was therefore rejected.

Discussion of Findings

Findings from research question one showed that ESL students taught listening comprehension using flipped classroom performed better with a mean gain of 24.32 than the group taught using lecturing method with the mean gain of 10.63. Again, results in Table 3 showed that the F-ratio was 13.629 and p-value was 0.000 which is less than 005 level of significance. This shows that difference in the mean gain is significant and so the null hypothesis which stated that there is no significant difference between the academic achievement mean scores of ESL students taught listening comprehension using lecture teaching method and those taught using flipped classroom was rejected. This implies that there was significant differences between the academic achievements mean scores of ESL students taught listening comprehension using lecture teaching method and those taught using flipped classroom. The finding is in line with the submission of Majid and Mohamad (2024) that when learners were provided the chance to study learning materials before class, it allows them more time to practice the target language and this improved their performance. The finding also supports the views of Zarinfard et al., (2021); Thinh (2021); Chen et al., in Trung (2024) that flipped classroom aims to improve teaching and learning efficiency.

In research question two, result showed that ESL students exposed to flipped classroom had a higher retention mean gain of 1.34 than students exposed to lecture teaching method with the retention mean gain of 0.30. The result in Table 4 indicates that the difference in the mean gain is significant. This is because the F-ratio is 14.405 and p-value 0.000 which is less than the 0.05 level of significance. The null hypothesis was rejected. This implies that there is significant difference between the retention mean scores of ESL students taught listening comprehension using lecture teaching method and those taught using flipped classroom. In other words, in flipped classroom, ESL students were able to internalize and also retain what they are taught. The finding is in consonance with the assertion of Turan and Akdag-Cimen. (2020) that flipped classroom allows for a more interactive and personalized learning experience as the instructor can furnish targeted feedback and help the learners overcome specific challenges they may face in listening to spoken English. That is to say that in flipped classroom, ESL students have personalized and interactive learning experiences which aid retention of learned content.

Conclusion

The findings of this study revealed that flipped classroom impacted more in improving ESL students' academic achievement and retention in listening comprehension than lecture teaching method. Significant difference was also found between the retention mean scores of ESL students taught listening comprehension using lecture teaching method and those taught using flipped classroom. This is due to the fact that the result revealed that NCE year three students taught listening comprehension using flipped classroom had a higher mean gain for achievement and retention than their counterparts taught using lecture teaching method. It follows therefore that if flipped classroom is adopted in teaching listening comprehension in F.C.E. (T), Umunze, ESL students will perform better in listening comprehension and retain what they have learnt. This will enable them acquire needed listening skills that will enable them become effective communicators.

Recommendations

The following are recommended based on the findings:

1. Teachers of English as Second Language (ESL) should adopt flipped classroom in teaching listening comprehension in order to enhance knowledge mastery and retention among ESL students.

2. ESL teachers should be sensitize and sponsored by government and other stakeholders to attend workshops, seminars and conference to receive training on the use of innovative technologies like flipped classroom in teaching.

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EXPLORING THE ROLE OF ANIMATION AND CARTOONS IN THE TEACHING AND LEARNING OF IGBO LANGUAGE IN THE EARLY GRADE SCHOOLS

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Abstract

This study explores the role of animation and cartoons as innovative tools in the teaching and learning of the Igbo language in the early grades. With the increasing decline in the use of indigenous languages among younger generations, there is an urgent need to adopt engaging and culturally relevant pedagogical approaches. Animation and cartoons, with their visual appeal and storytelling capabilities, present an opportunity to make language learning more interactive, relatable, and effective. This research investigates how these multimedia resources influence pupils' interest, comprehension, and retention of the Igbo language. Through a combination of qualitative method and descriptive approach based on experience, classroom observations, teacher interviews, and student performance assessments. The study examines the effectiveness of animated content in enhancing linguistic skills such as vocabulary acquisition, pronunciation, and sentence construction. The findings reveal that animation and cartoons significantly boost learners' motivation and participation, thereby supporting language preservation and revitalization efforts. The study concludes with recommendations for integrating locally produced Igbo-language animated materials into early grade school curricula as a strategic approach to sustaining indigenous language education.

Key Words: Animations and cartoons, Igbo language, teaching and learning, early grade

Introduction

Language is not only a means of communication but also a very important carrier of culture, identity, and heritage. In Nigeria, Igbo language like many other indigenous languages, is going through a gradual decline in fluency and usage among the younger generations. This has posed a problem to stakeholders of education in the past few decades and now raises urgent questions about effective and engaging methods to revitalize indigenous language leaning especially in early education. In an age of digital media dominance, children are increasingly drawn to audio-visual contents such as animations and cartoons. These mediums, if strategically developed and applied to the teaching and learning of Igbo language in the early grades will hold immense potential to enhance Igbo language acquisition and sustain interest through their motivating capability in the lives of Igbo children.

This paper explores how animation and cartoons can serve as pedagogical tools in the teaching and learning of Igbo language at the foundational level of education by examining current practices, learner engagement, and the linguistic outcomes associated with media-based instruction. The study aims to highlight innovative strategies for integrating culturally relevant content into early grade classrooms. The research also seeks to contribute to the broader discourse on language preservation and the modernization of educational methodologies in a multilingual society like Nigeria.

Animations and Cartoons

Animated cartoons are animated films or movies. It is a short hand-drawn moving pictures for cinema, television or computer screen, featuring some kind of story or plot. Animation is the optical illusion of motion created by the consecutive display of images of static elements. According to Ramesh (2021), animation is the art of making an illusion of motion through the use of rapid progression or sequential images.

It is the processor creating the illusion of motion and shape charge by means of the rapid display of a sequence of static images that minimally differ from each other.

In the context of education, animation refers to a technique that creates the illusion of movement through a rapid sequence of images or drawings, often enhanced with audio narrations, music, and dialogue. Educational animations are typically designed to present information in an engaging, visual format that aids in comprehension, retention, and learner motivation (Mayer 2009) when used for language instruction, animation can help learners understand vocabulary, sentence structure and pronunciation by linking spoken words with relevant images and actions.

Cartoons, on the other hand, are simplified exaggerated visual illustrations – either static or dynamic. In educational context, cartoons are used to tell stories or model behavior and language use in relatable contexts for children. They frequently incorporate humor, repetition and everyday situations, making them effective for engaging early-grade learners in the languages acquisition (Algahtani 2015) These two (animation and cartoon) are forms of visual media that support multimodal learning where learners process information through more than one channel; visual, auditory, and sometimes kinesthetic. Therefore, when integrated into language learning, serve as pedagogical tools to accelerate understanding, enhance listening and speaking skills, and foster cultural awareness.

Early Grades

This term is used to refer to the foundational years of formal education. It cover the primary 1 to 3 which corresponds to children between ages 5 to 8 in Nigeria educational system (FRN 2013). This stage in a child's life is a critical period for cognitive, linguistic and socio-emotional development. During these early grades, children acquire basic literacy and numeracy skills and their brains are especially

receptive to language input, making this an ideal period for the introduction and reinforcement of mother-tongue instruction. In the case of Igbo language education, early grades represent a unique opportunity to build foundational language skills like listening, speaking and vocabulary development, and early reading. According to UNESCO (2016), children learn best in their mother tongue during the early years of schooling.

Targeting the early grade learners, Igbo language educators can nurture linguistic competence at their formative stage, ensuring that they internalize the structure, sounds, and expression in Igbo language before learning other languages. The use of engaging tools such as animations and cartoons at this stage will further enhance language retention and learner motivation.

Igbo Language and Speakers

Igbo language belongs to the Benue-Congo group of the Niger-Congo language family. It is spoken predominantly by the South-Easterners of Nigeria. According to the Indiana University (IU) center for language technology, Igbo is one of the largest languages of West Africa and it is spoken by 44 million people in Nigeria. Abanyi (2023) states that Igbo language is spoken predominantly in South-Eastern states of Nigeria like Abia, Anambra, Ebonyi, Enugu, and Imo and also occupy part of states like Bayelsa, Delta, Rivers, Cross River, Benue and Kogi states. According to IU Center for Language Technology, Igbo language speakers can also be found in Cameroon and Equatorial Guinea. Igbo language elements were also retained by enslaved people in the America's - Cuba, Barbados, and Jamaica. The language is now a global diasporic language, spoken in the US, Canada, Great Britain and elsewhere across the world. (IUCLT)

Igbo language has a rich history that dates back to centuries. Historically, Igbo people have been known for their complex societal structures, trade networks, and cultural practices (Nwankaegu 2024). The language was primarily oral with traditional folktales, Idioms, proverbs, and songs. All these play a central role in preserving the cultural heritage and knowledge of the people. The written form of the Igbo language began to develop during the colonial period with the effort of Christian missionaries who translate religious texts into Igbo language. This period also saw the creation of the first Igbo alphabets and grammar books, which helped to standardize the language to an extent. (Nwankaegu 2024)

Importance of Preserving Igbo Language

Igbo language being one of the three major indigenous languages in Nigeria, is facing a gradual but alarming decline in usage, particularly among the younger generations. While it remains widely spoken in the South-Eastern Nigeria and among diaspora communities, research and observations increasingly indicate a shift towards the dominance of English and Nigerian pidgin in homes, schools, and media. (Eze and Nwafor (2020), UNESCO (2003) This trend threatens not only the linguistic survival of Igbo but also the cultural heritage, identity, and world view embedded within the language.

Abanyi (2023) states that the primary aim of teaching Igbo language in schools is to develop communication skills but language is more than just a tool for communication; it is a carrier of culture, value, history and indigenous knowledge system (often referred to by some people as “native intelligence). The Igbo language encodes proverbs, folktale, songs, greetings, and expressions that shape how its speakers understand the world. When a language declines, much of these intangible

cultural wealth is lost. Therefore, the preservation of Igbo is not only a linguistic concern, but also a cultural and national imperative.

The urgent need to preserve Igbo language has also been supported by the UNESCO's classification of Igbo language among the African languages that are endangered and about to go extinct. This is largely due to the obvious decline in inter-generational transmission. A key strategy to reverse this trend is the motivation of this paper. The one major way to rescue Igbo language from imminent extinction is by targeting language learning during the early grades when children are most capable of acquiring fluency. At this stage, children are highly impressionable and are forming the linguistic and cultural foundations that will shape their identity.

Despite policy support for mother-tongue education in Nigeria (FRN 2013), Igbo language is often underutilized in schools, especially in urban and private institutions where English is prioritized. To preserve the language effectively, there must be a deliberate effort to integrate Igbo into early childhood education through methods that are relevant, engaging, and accessible to today's Igbo language learners. One of such method is the use of animations and cartoons which blend entertainment with education and can re-introduce Igbo language and culture in visually stimulating and emotionally resonant way. Thus, incorporating Igbo language learning into modern digital media not only will preserve the language but also make it attractive to young learners, helping them to form positive attitude towards speaking and understanding their mother-tongue. Therefore, preservation efforts must go beyond the language teaching and embrace innovative, technology-driven strategies that meet children in their world, screens, stories and sounds.

Animation and cartoon, popular among children, present a powerful yet underexplored avenue for language acquisition. This paper draws on Richard Mayer's cognitive theory

of multimedia learning and other education theories which examine how multimedia elements like narration, imagery, and contextual visuals can enhance the teaching and learning of Igbo language.

This paper therefore argues that the integration of animation and cartoons in the early instruction of Igbo language will significantly enhance learning outcomes as supported by Mayer's theory and others thereby promoting deeper cognitive engagement, retention, and motivation among young learners

Literature Review

In this part of the paper, it is important to look at some educational theories that support the fact that animations and cartoons offer us powerful tools for making Igbo languages more accessible, engaging and effective in learning context.

Richard Mayer's (2020) Cognitive Theory of Multimedia Learning (CTML) proposes that learning is enhanced when information is presented through both visual and auditory channels; rather than relying on a single channel like text alone. In Mayer's theory, the core idea is that people learn more deeply from words and pictures when combined than when words are used alone. This theory makes animation and cartoon very relevant as a multimedia tool in early grade language learning. Mayer's theory presents us with 12 principles of multimedia learning and going by multimedia principles, Igbo language learners in the early grades can benefit from animations and cartoons because these two combine narrations, which is verbal or spoken words, with visuals in the form of characters, cultural settings and actions are all embedded.

The modality principle also states that people learn better from graphics and on-screen texts therefore cartoons that use spoken Igbo words rather that written Igbo words cater for young learners' auditory strengths and reduce reading load, thereby enhancing comprehension. The temporal contiguity principle states that people learn

better when corresponding words and pictures are presented simultaneously rather than successively. Therefore, real-time narrations in Igbo while an action is being animated helps pupils make immediate connections between language and meaning (Mayer 2020)

The personalized principle states that people learn better from conversational style than formal style therefore favors the use of cartoons and animations which often use a casual, friendly tone and relatable characters which create a more engaging and emotionally supporting environment for language learners. The pre-training principle; this principle states that people learn better from a multimedia lesson when they know the names and characteristics of the main concept. Therefore supporting animations which can introduce basic Igbo vocabularies like that of things we can see in our environment, Igbo greetings, colors, e t c in a pre-training model before moving to more complex sentences or grammatical levels Mayer (2020)

Paivio's (1986) educational theory also states that humans process information through two separate cognitive systems: one for verbal information (language) and the other for non-verbal information (images and animations). When both channels are engaged, as in with animations with speech or sub-titles, learning and retention improves. Igbo language studies suffer from low engagement which needs a quick fix. Animations and cartoons on the other hand offer solutions as it increases motivation and cultural relevance. Limited exposure to fluent Igbo usage in urban environment is one big problem but cartoons provide immersive, consistent language input. The abstract nature of language rules which young learners find cumbersome is solved through the cartoon and animations' visually concretized meanings and syntax.

Vygotsky's (1978) constructivist learning theory is another theory supporting the use of cartoons and animations as a teaching pedagogy. It holds that learners actively construct their own understanding by interacting with their own environment,

building on prior knowledge, and making sense of new experiences in meaningful contests. In the contest of Igbo language instruction for early grade learners, animations and cartoons serve as powerful constructivist tools. They immerse children in authentic every day Igbo contexts such as family life, greetings, storytelling and cultural practices, where they can make sense of the language naturally and experiencially. This particularly is lacking in diasporic communities and urban centers. One of the key constructivist elements is that 'learning is active'. Watching an animated cartoon in Igbo is not a passive exercise. Children, when watching cartoons interpret gestures, listen to dialogues and respond emotionally and cognitively. When cartoons and animations are used interactively in the classroom through pauses, discussions or reenactment, this tools encourage active participation which is a core constructivist principle.

Another element of constructivist theory of learning is that of real world and cultural contexts. Cartoons in Igbo often depict familiar cultural settings; village life, festivals, meals, greetings and more which allow children to connect new language input to their existing cultural knowledge making learning more meaningful and memorable. There is a different component of constructivist theory which is that of social learning. When children watch and discuss Igbo cartoons with peers and teachers, they engage in socially-mediated learning. This interaction supports language development in what Vygotsky called 'The Zone of Proximal Development' (ZPD). It means learning just beyond what a child can do alone but achievable with support.

In line with constructivist learning goals, cartoon and animations do not merely transmit Igbo vocabulary; they encourage children to observe, infer, interpret and use the language in context. Therefore, grounded in this theory, the use of cartoons and animations in Igbo language instruction provides a rich interactive platform for children

to construct linguistic knowledge, rather than rote memorization, learners engage with animated characters, cultural and narrative situations that reflect their lived realities through active participation and social interaction. Pupils begin to internalize not only vocabulary and grammar but also social norms and cultural nuances of Igbo communication. This aligns with Vigotsky's emphasis on learning through mediated, context-rich experiences, suggesting that animation is not only engaging but also pedagogically sound.

There are works carried out on animations and cartoons by different authors. For instance, Odogwu et al (2024) carried out a study titled Psychological Appeal in Digital Media Animation for Learning in Nigeria and found out some prospects in digital media animation for learning in Nigeria as it is capable of improving learning outcomes with challenges such as limited technology access and cultural disparities identified. They therefore recommends investing in digital infrastructure, fostering cultural sensitivity in content creation and promoting stakeholder collaborations. Okuley et al (2025) in their work titled "A Critical Discourse Analysis of Selected Animated Cartoons of African Origin" reported that "animated cartoons provide entertainment for children. In addition they serve as agents of socialization". He also discovered that animated cartoons are embedded with certain ideologies or world views capable of changing the mindset of children. These suggests that when it is intended for educational purposes, it should be done with caution. This also means that cartoons are capable of playing dual roles being educational and ideological tools. Ghilzai et al (2017) and Ramesh (2021) revealed that animated cartoons aid brain development, language acquisition, learning of skills, teamwork, creativity, problem solving skills, as well as the development of moral values. These studies prove that cartoons and animations offer

broader pedagogical advantages if well designed and tailored especially toward language acquisition and learning

Roles of animation and cartoons in the teaching and learning of Igbo language in the early grade schools

- **Engagement and Motivation**

Over the time, the introduction of animated Igbo cartoons made of Igbo folktales significantly heighten pupils engagement. The moment animation began, particularly one that feature colorful visuals, familiar cultural characters, or humorous animal antiques. Learners became noticeably attentive and participatory. Pupils not only laughed and responded enthusiastically but also mimicked character voices and repeated phrases. This aligns with the findings of Odogwu et al (2024), who noted that digital media incorporating local elements boosts classrrom motivation and learners' involvement.

- **Vocabulary Development and Recall**

Animations that included repetition of Igbo words, songs and conversational phrases appeared to support language recall. In several classroom experiences, slow learners and those who struggle with text-based vocabulary were able to recall and pronounce Igbo greetings, numbers, animal names and objects more confidently after repeated exposure to animated contents. This is in line with Ghilzai et al (2017), who demonstrated that computer animation enhances retention and learning in young learners. The multimodal approach (Mayer's multimodal principle); combining auditory and visual input supports Paivio"s dual coding theory which posits that the integration of images and words strengthens memory

- **Cultural Familiarity and Identity**

Animations helps to reinforce cultural identity in a significant way. Children often show a deeper emotional connection to stories that mirrored their home experiences and tales they had heard from parents or elders here suddenly brought to life on screen. This made the language feel less foreign and more rooted in their everyday lives. The animated story telling approach used by creators like Udochi Okeke exemplifies this impacts, as traditional Igbo values are woven seamlessly into visually rich narratives.

Teachers' Perspective and Practical Challenges

Though there are many benefits of incorporating animated content into Igbo language instruction for early grade learners, there are however several challenges emerge in in the practice of it. Most challenging among others happen to be the limited availability of high-quality Igbo language animations, lack of teacher training in digital integration and infrastructural issues such as poor internet access in some schools just as Okuley et al (2025) noted, while digital tools have transformative potential in language education, their effectiveness depends largely on the access and implementation capacity

Conclusion

The use of animations and cartoons in teaching Igbo language enhances learner engagement, promotes vocabulary retention, and fosters cultural connection. These tools, when thoughtfully devel0oped and applied can transform language learning into an enjoyable, memorable and culturally relevant experience for young children the findings suggest a strong case for the integration of animation into early language curriculum, supported by appropriate resource training and development,

Recommendations

The following recommendations are thereby made as a way to maximize the positive impact of Igbo language cartoons and animations in the early grade classrooms

1. Integrate animations and cartoons into the Igbo language curriculum for early grades
2. Teachers should be trained to use digital tools effectively especially that of animations and cartoons
3. Government and NGOs should support local creators in the production of high-quality Igbo language animated content
4. Government and stakeholders should make and support policies for the funding of digital learning tools.
5. More researches should be carried out on the use of animations and cartoons and that should be based on measurable learning outcomes and empirical research.

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AWARENESS OF ARTIFICIAL INTELLIGENCE IN TEACHING AND LEARNING OF SCIENCES, FCT COLLEGE OF EDUCATION ZUBA, ABUJA, NIGERIA

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Abstract

This study examined awareness of Artificial Intelligence (AI) in teaching and learning of sciences in FCT College of Education, Zuba Abuja Nigeria.. The population of study comprised all lecturers in School of Sciences FCT College of Education, Zuba of 2024/2025 academic session. The sample size comprised of 50 lecturers selected by stratified and simple random sampling techniques from population of 150 lecturers from school of sciences, FCT College of Education Zuba. The research design adopted was descriptive survey design. Data for the study was collected using researchers developed questionnaire tagged Lecturers' Awareness on Artificial Intelligence Tools for Teaching and Learning Questionnaire (LAAITTLQ). Validated by the expert and reliability coefficient of 0. 82 was obtained one research question was raised and answered using mean and standard deviation while one null hypothesis was tested at $\alpha = 0.05$ level of significant using t- test. The AI tools examined in the study include: ChatGPT, PowerPoint Speaker Coach Quillbot, Perplexity, Scholarcy, Grade scope, etc. The result of analysis showed that the science lecturers have awareness on some Artificial Intelligence (AI) tools, the result on gender showed that there was no significant difference in the level of awareness of male and female lecturers on the use of AI tools. Based on the findings it is therefore recommended that workshops and training on the use of AI tools in teaching and learning should be organized in the school to boost the science lecturers' knowledge and skills on Artificial intelligence (AI) tools

Keywords: AI, Awareness, Gender, Learning, Teaching Technologies, Science

Introduction

Science education serves as a cornerstone for innovation, economic development and informed citizenship in the 21st century. As global societies become increasingly reliant on scientific and technological advances, the demand for effective and inclusive science instruction continues to grow. However, traditional science education faces persistent challenges: rigid curricula, one-size-fits-all instruction, limited laboratory resources and inequities in access to Artificial Intelligence (AI) technologies. The ability of artificial intelligence to process data, learn from patterns and adapt to user needs, offers promising solutions to these challenges. According to Ukeh and Anih (2024), AI has emerged as a transformative force across various sectors, offering innovative solutions to complex problems. AI as a multidisciplinary science with numerous approaches that operates based on the combination of enormous amounts of digital data and intelligent algorithms that let machines "learn" automatically by having the capacity to read and understand guidelines and data so that they analyze and act following logical reasoning and behave in a way that is comparable to humans (Sharma, 2024)

AI Awareness among Science Educators

With unprecedented technological advancements, Artificial Intelligence (AI) has necessitated a paradigm shift in the field of science education (Karaca & Kılcan, 2023). The need for the integration of this to area of study in teaching and learning in college of education and other tertiary institutions has been an issue of discourse in recent research works. As the learners have started using AI tools in doing assignments, the lecturers need to be aware of the tools in a bid to help students use them appropriately for learning. This is supported by Vinothkumar and Saratha (2024) who stated that AI can enhance the grading procedure, improve accessibility of learning materials, automate processes, and enable students have a personalized learning experience.

In line with the fore going, the use of these tools like other technologies in the classroom by the science lecturers depends on the awareness of their existence. According to Rahman and Kodikal (2023) awareness play significant role in influencing the adoption of AI within the higher education system. Onwuagboke (2023) was apprehensive that the integration of technologies in Nigerian tertiary institutions has progressed rather slowly probably as a result of mass unawareness of the existence of these technological tools. Specifically, awareness is the ability to directly know and perceive, to feel, or to be cognizant of events.

Apart from the awareness of the existence of the tool, it is also important for the lecturers to have pedagogical knowledge of how to utilize them in the learning environment for the benefit of the learners if the benefits of such tools in education are to be achieved. There are variables such as gender that can be responsible for differences in awareness of AI tools among lecturers. Gender is one of such

Gender of the lecturers is one variable that can be responsible for difference in lecturers' awareness of AI technologies for learning. Vinothkumar and Saratha (2024) discovered no differences in awareness between male and female postgraduate students' awareness of AI tools for learning. Similarly, Thomas (2022) found that there was no difference in awareness of AI tools for teaching between male and female lecturers at the Federal University of Technology Minna. Khalid and Khan (2022) on the other hand, discovered a digital divide in technology use occasioned by the outbreak of the COVID-19 pandemic and maintained that the gap should be further investigated and bridged.

AI Tools used in Science Education

There are many AI tools used in the teaching and learning environment which include but not limited to the following:

ChatGPT (Conversational interaction, generative, pre-trained transformer): This is an AI Chabot that simulates human speech through natural language processing. The language model may write emails, articles, essays, code, social media postings, and other textual content in addition to responding to queries (Alimi*, et-al*, 2023).

Mendeley: This is an easy-to-use AI application that lets you correctly arrange, share, and cite all of your research articles in one location. It facilitates easier document annotation, improved bibliography creation, and PDF organization.

Consensus: Consensus is an AI-driven search engine that specializes in extracting and condensing scientific insights from peer-reviewed sources. The goal is to liberalize access to expert knowledge and make science more approachable.

Research Rabbit: Research Rabbit is a free online citation-based visual literature review mapping software tool which connects your research interests to related articles and authors.

QuillBot: This is an online AI writing platform with a number of tools which enables the user to rewrite, check grammar and plagiarism, as well as translate, outline and create citation thus making way for successful writing (Pfeifer, 2024).

Scholarcy: This is an online tool that employs AI technology to summarize long research articles, reports, and documents into easy-to-digest summaries.

Gradescope: This is AI grading software that lets students turn in assignments online in order to receive faster and more detailed feedback on their work. It gives lecturers comprehensive analytics on assignment and question while keeping the original work and allow for quick and easy viewing from anywhere.

ClassPoint: ClassPoint is a Classroom Response System that can be embedded in Microsoft PowerPoint allowing users to turn their existing slides into an interactive

presentation and seamlessly deliver quiz questions within PowerPoint without the hassle of switching to another application during teaching (Bong & Chatterjee, 2021).

MATHia: This is online math learning programme that personalizes instruction for middle school and high school students tailored to their own learning style.

Scite: Scite AI is online tool that mainly focuses on evaluating the reliability of scientific claims. It enables researchers to analyze the citation context of a paper to determine if the citation supports or disputes the cited claim.

ChatPDF: This is an innovative AI-powered tool that transforms how we interact with PDF documents. The natural-language conversational interface lets users quickly ask questions and get precise answers from any PDF file.

Perplexity: Perplexity combines AI with web search to produce ready-made answers. It cites its sources, which are real but tend not to be scholarly. Again, it is possibly best suited to generating ideas and identifying sources than to any significant contribution to producing a review (Nyaaba, *et-al,* 2024).

Gemini: Google Gemini is an AI-powered Chabot tool designed by Google to simulate human conversations using natural language processing and machine learning. It aims to allow for more natural language queries, rather than keywords, for search (Adeolu, *et-al*, 2024). The AI tools discussed are just a few of the many evolving tools for teaching and research that educators should be aware of

Integration of AI tools in Teaching and Learning

Most of these AI tools are free with some of the paid tools having a free version. Ortiz, (2023) discussed the various applications of AI in learning, using ChatGPT as a good example as the tool has become popular among students and lecturers in recent time. Some researchers have stated that ChatGPT can be used in many ways to save time in learning like in: Brainstorming; Generating an outline, Conducting literature review,

Getting access to sources; Asking for specific examples and • Generating citations (Biswas, 2023; Ortiz, 2023).

Ross (2023) identified four ways AI tools like ChatGPT can be used by a teacher in the classroom and advised that: Lecturers should have the awareness of their existence as the students are well aware that AI tools such as ChatGPT exist and are already experimenting with them on their own. Lecturers should use AI alongside their students. This can be done by engaging with generative AI tools with their students in person, when possible. Otherwise, they should share AI-generated responses to questions during class time and ask students to consider them. In the alternative, lecturers should allow students to experiment with the AI tool at home, write down their experiences, and then share them with the class. The lecturers should be aware of the nature of the tool and as a result, teach students how to ask the ChatGPT tool questions and the AI tools can be used to spark the imagination of the students.

Furthermore, teaching with AI tools will challenge science educators to change their pedagogical approach from what it used to be when they taught without AI. Centre for Teaching and learning (2023) advises lecturers to integrate AI into learning by giving assignments that support students in developing linked thinking and writing by discussing, drafting, and revising ideas concerning sources and evidence

Given the plethora of emerging AI technologies and their benefits in education, the researchers is of opinion that many of the lecturers in the college were not aware some of AI tools, or not use them in their teaching and learning, this may be as a result of insufficient awareness of these tools among lecturers in the college. This is more so as lecturers cannot use tools they are not sufficiently aware of their existence and their usefulness in their teaching and; learning works. (Olawuwo, 2025 Field work)

Statement of problem

In spite of the importance and popularity of science subjects in Nigeria Certificate in Education, academic performance of students in colleges of education has not improved (Adeolu, *et-al*, 2024). The desire to know the causes of the poor performance in science subjects has been the focus of researchers for some time now. It has been observed that one of the reasons for poor performance in science subjects is caused by teaching strategies adopted by the science lecturers, Students also perform poorly in sciences because the science classes are boring, usually too large class size and ill-equipped laboratories(Balarabe, 2016). Given the plethora of emerging AI technologies and their benefits in education, this might help to solve the problem thereby increases the students interest and attention towards learning. Also the researchers observed that many of the lecturers in the college do not use AI in their teaching and learning process (Ross, 2023). This may be as a result of insufficient awareness of these tools among lecturers in the college. This is more so as lecturers cannot use tools they are not sufficiently aware of their existence and their usefulness in their teaching and learning process. This study is therefore designed to bring to light the importance and awareness of these technologies in their adoption and integration in teaching and learning process

Aim and objectives of the study

The aim of the study is to assess the awareness of science lecturers on awareness artificial intelligence (AI) in college of education, Zuba, FCT, Abuja. The study sought to:

1. Determine whether science lecturers have the awareness on artificial intelligence (AI) for science instruction
2. Determine whether there is a difference in the levels of awareness of male and female science lecturers on artificial intelligence (AI)

Research questions

1. What is the level of science lecturers' awareness on artificial intelligence (AI)

Research hypotheses

1. There is no significant difference in the level of awareness of male and female science lecturers on artificial intelligence (AI)

Methodology Descriptive survey design was adopted for this study. According to Creswell (2018), descriptive survey design is appropriate for obtaining factual, attitudinal or behavioural information from selected samples. It is considered appropriate for this study because the lecturers' awareness was investigated through the use of questionnaire

Population of the study: The population of the study comprised all the science lecturers (Biology, Chemistry, Physics, Mathematics, Computer, Integrated science and Physical and health education) from school of sciences in FCT College of Education, Zuba Abuja.

Sample and sampling technique: There are ninety seven lecturers in the school of sciences .The sample comprises of 50 lecturers (26 male and 24 female) science lecturers selected by stratified based on their gender and simple random sampling techniques from school of sciences, FCT College of Education, Zuba, for 2024/2025 academic session.

Instrumentation and Administration: The instrument used to generate data was a questionnaire titled: Science Lecturers' Awareness on Artificial Intelligence questionnaire (SLAAIQ).. The respondents were expected to choose from options: Not at all Aware, Slightly Aware, Somewhat Aware, Moderately Aware and Extremely Aware. The instrument was administered on the respondents and retrieved on the spot after completion

Validity and Reliability of Instrument

The instrument was face and content validated by two senior science lecturers and one lecturer in measurement and evaluation from University of Abuja. The test items were thereafter reduced from 20 to 16 and later reduced to 15 items according to experts recommendations. Their corrections were incorporated into the final form of the instrument before administration. Pearson product moment was used to determine the reliability, 0.82 - efficient was obtained which was considered reliable for the study, the 5 point Likert scale assigned weights as follows: For positive response: Extremely aware (5), Moderately aware (4), Somewhat (3) Slightly aware (2) and Not at all aware (1) while negative response: Not at all aware (5), Slightly aware (4), Somewhat aware (3), Moderately aware (2) and Extremely aware (1). Mean response of **45.10 – 75.0** was considered as aware and **15.0 – 45.0** as Not at all aware

Data Analysis Mean and standard deviations was used to answer the research question while t- test also used to analyze the hypothesis.

Result

Research question 1: What is the level of science lecturers' awareness on Artificial intelligence in term of gender and qualification?

Table 1: Science lecturers' awareness on AI

S/N		N	Mean	SD	Decision
1	I am aware of Grade scope as AI teaching tool	50	2.28	. 89	Rejected
2	I know Power point Speaker Coach as AI teaching tool	50	2.75	. 67	Accepted
3	I am knowledgeable of Class Point as AI teaching tool	50	2.61	.84	Accepted
4	I know MATHia as AI teaching tool	50	2.23	.82	Rejected
5	I am knowledgeable of Audio Pen as AI teaching tool	50	2.28	.84	Rejected
6	I know Eduaide as AI teaching tool	50	2.33	.82	Rejected
7	I am aware of ChatGPT as AI teaching tool	50	3.23	.66	Accepted
8	I am aware of Medley as AI teaching tool	50	2.89	.69	Accepted
9	I am aware of Consensus as AI teaching tool	50	2.29	.82	Rejected
10	I am aware of Research Rabbit as AI teaching tool	50	2.41	.83	Rejected
11	I am aware of QuillBot as AI teaching tool	50	2.36	85	Rejected
12	I am aware of Scholarcy as AI teenceaching tool	50	2.24	.80	Rejected
13	I am aware of Scite as AI teaching tool	50	2. 20	.74	Rejected
14	I am aware of ChatPDF as AI teaching tool	50	2.72	.70	Accepted
15	I am aware of Perplexity as AI teaching tool	50	2.63	.76	Accepted
16	I am aware of Gemini as AI research tool	50	2.91	.67	Accepted
Cumulative Mean					**2.52**
Accepted					

Table 1 revealed that seven items out of sixteen items received mean scores above 2.5 while nine items received mean scores below 2.5. The Sixteen items received a cumulative mean scores of 2.52 which is slightly above the benchmark of 2.5, therefore, the result indicated that the lecturers were aware of some AI tools and lacks awareness

on majority of AI tools for teaching and learning. Although it has been revealed that the lecturers were aware of some AI tools for teaching and learning based on the cumulative mean (M= 2.52), a closer look at the number of AI tools that lecturers responses show awareness (7) and the ones that their responses show lack of awareness (9), it may be said that there is insufficient awareness of most of the AI tools listed

Ho 1: There is no significance difference in the level of awareness of male and female science lecturers on *Artificial intelligence*

Table 2: *Result on T – **test** awareness of male and female science lecturers on Artificial intelligence*

Gender	N	$\overline{X}$	SD	Df	Cal. t	Sig. (2-sided)
Male	26	60.00	10.27			
				23	0.164	0.871
Female	24	59.36	8.68			

Table 2 revealed the result of respondents' awareness on *Artificial intelligence* where the computed p – value of 0.164 is greater than p – value of 0.05 therefore the null hypothesis is accepted, that means there is no significance difference between male and female science lecturers' level of awareness on Artificial intelligence. That the gender has no effect on lecturers' awareness on the use of AI in teaching and learning process

Discussion

The findings of the study have revealed that the Science Lecturers who participated in the survey were not aware on majority of the AI tools that can be used in teaching and learning processes. They showed reasonable awareness on seven AI tools among others namely ChatGPT, PowerPoint Speaker Coach, ClassPoint, ChatPDF, Medley, Perplexity and Gemini. Being aware of a particular set of tools may not be enough hence science lecturers should keep track with AI technological developments if they must reap their numerous benefits in education. This result is in line with the findings of Thomas (2022), Alimi, et al. (2021) and Ghimire, et al. (2024) that reported that there were increase in awareness of lecturers on the use of some AI tools for teaching and

learning. The lack of awareness on majority of the AI tools for teaching may be as a result of the fact that these tools are fast evolving at a speed that lecturers are yet to be abreast with. As the learners have started using AI tools in doing assignments, the lecturers need to be aware of the tools in a bid to help students use them appropriately for learning. This is supported by Vinothkumar and Saratha (2024) who stated that AI can enhance the grading procedure, improve accessibility of learning materials, automate processes and enable students have a personalized learning experience In line with the fore going, the use of these tools like other technologies in the classroom by the science lecturers depends on the awareness of their existence. According to Rahman and Kodikal (2023) awareness play significant roles in influencing the adoption of AI within the higher education system

It has also been revealed by the findings of this study that there is no difference in awareness of AI tools for teaching and learning between male and female lecturers who participated in the study. This result aligns with Vinothkumar and Saratha (2024) that there is no significant differences in awareness between male and female science lecturers' awareness on AI tool, this is also in support with what Thomas (2022) found out that there was no difference in awareness of AI tools for teaching between male and female lecturers at the Federal University of Technology Minna. In contrary to Khalid and Khan (2022) on the other hand discovered that a digital divide among male and female lecturers in the use of technology during the outbreak of the COVID-19 pandemic and maintained that the gap should be further investigated and bridged.

Conclusion

In conclusion it is evident from the study that science lecturers at FCT College of education, Zuba were aware of some AI teaching and learning tools with no significant difference between male and female lecturers. The importance of integration of AI into

teaching and learning is numerous and the Science lecturers at FCT College of education, Zuba cannot lag behind as a result of lack of awareness of relevant tools.

Recommendations

Based on the findings of the study, the researchers made the following recommendations.

1. FCT College of education authorities should as a matter of necessity mount mandatory awareness workshops and trainings for lecturers on emerging AI technologies to enable them to be well informed about how to integrate them into teaching and learning.

2. Ethical consideration should be addressed by the college establishing guideline to be followed in the integration of AI in curriculum thereby promoting transparency and fairness in AI-enabled assessment practices.

3. College administrators should ensure gender equity in selection of staff for regular pedagogical training on the use of AI in teaching and learning.

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ADVANCING INCLUSIVE SCIENCE EDUCATION: NEW PEDAGOGICAL INNOVATIONS FOR STUDENTS WITH SPECIAL NEEDS.

By

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Abstract

The evolving landscape of education has transitioned from exclusionary practices and demands innovative and inclusive approaches, particularly in teaching science to students with special needs. This paper explored the historical progress as well as challenges of teaching science to student with special needs. It examined the current innovations in teaching science to special children with transformative strategies such as adaptive learning, multisensory engagements, universal design, assistive technology and culturally responsive pedagogy. This paper highlighted the impact of these innovations on academic outcomes. The goal is to create equitable and empowering science classrooms where all learners can thrive. This paper also examined global and recent advancements and concludes with strategic suggestions to further enhance science education for students with special needs.

Keywords: Universal Design of Learning, Innovative Technology, Students with Special needs

Introduction

Historically, students with special needs faced barriers in accessing quality science education due to rigid curricula, inaccessible instructional strategies and limited teacher training. Education is undergoing a profound transformation, driven by technology, inclusive pedagogy and a growing awareness of the diverse needs of learners. For students with special needs, especially in science education, traditional method often fall short, and the journey often reflects broader social and political transformation (Winzer 2009). Revolutionizing education for special needs learners requires rethinking teaching strategies, leveraging adaptive technologies, and cultivating inclusive environment that empower every student to explore, experiment and excel. Science education plays a crucial role in developing critical thinking and problem solving skills .Students with special needs often encounter systemic barriers that limit their full participation (UNESCO 2020)

Historical progress

The education of students with disability was once characterized by segregation and a lack of curricular adaptation. Prior to the 1970's, children with disabilities were often excluded from formal education and placed in institutions (Friend, 2021). The passage of IDEA (individuals with Disabilities Education Act) in 1975 marked the turning point, mandating free and appropriate education in the least restrictive environment (U.S Department of Education,2020). In spite of this progress, science instruction remains under developed due to perceived incompatibility with hands-on learning and safety concerns, as well as rigid Text book reliance and minimal use of multisensory strategies. The introduction of the UDL (Universal Design of Learning) framework in the early 2000s revolutionised the landscape by advocating multiple means of Engagement, representation, and expression (CAST, 2018). These pedagogical principles, combined

with assistive technologies like screen readers, tactile graphics, and augmented reality, created new pathways for inclusion in science classrooms (Okolo & Bouck, 2021).

Challenges of Teaching Science to Special Needs Students

One among many of the major challenges of teaching science to special needs students is curriculum design; others include instructional delivery, assessment and classroom management.

3. **Curriculum Inaccessibility**

   Abstract Content: Science often involves abstract concepts like atoms, energy, ecosystems, etc that are difficult for students with cognitive or learning disabilities to grasps without substantial modification (Bouck et al, 2021).

   Lack of adapted materials is another area of concern as many textbooks and lab materials are not available in accessible formats such as Braille, large print, or simplified language (Morash et al, 2015).

4. **Instructional Barriers**

   Traditional methods of teaching science instruction may rely heavily on lectures or reading, which is disadvantageous to students with auditory, visual, or learning impairments (CAST 2018).

   Although tools like screen readers and voice to text software exist, many schools lack infrastructure or teacher training to implement them effectively (Okolo & Bouck, 2021). This gap leads to reduced comprehension and disengagement, as students are unable to access materials in ways that match their learning strength.

5. **Safety and Hands-On Activities**

   Hands-on science experiments can pose safety risk, (laboratory safety), especially for students with mobility challenges, visual impairments, or behavioural issues (Friend, 2021). Students with mobility impairments may

struggle to navigate crowded labs, while those with visual impairments face heightened risk when handling chemicals or glassware. Some educators may exclude special needs students from lab activities due to perceived risks, fearing liability or accidents, thereby limiting experimental learning opportunities critical to science learning.

6. **Teacher Preparedness and Training**

Due to lack of specialised training, many science teachers feel unprepared to differentiate instruction for students with disabilities (Al-Azawei, et al., 2019). Due to poor collaboration also, special educators may not be included in science lesson planning, resulting in fragmented or inconsistent support. Without knowledge of Universal Design of Learning (UDL) or differentiated learning, teachers may unintentionally exclude students with disabilities.

7. **Assessment Difficulties**

Standardized Testing Limitations: Traditional assessments like multiple-choice exams, timed lab tests, or essays may not fairly measure the understanding of students with special needs, especially those with communication or processing delays. Limited Alternative Assessment is an aspect where very few schools implement performance- based or visual assessments tailored to individuals learning profiles (kuo et al., 2020). For example, a student with dyslexia may understand the water cycle but score poorly on a written test, while performing well when asked to explain it verbally or through diagram.

8. **Time and Resource Constraints**

Time-Burden: teachers often struggle with Preparing individualized lessons, adapt lab experiments, provide one-on-one support, especially in overcrowded classrooms, and managing accommodations takes time, and many teachers may

lack this skill. Many schools with limited budgets do not allocate enough funding for assistive technology, inclusive lab equipments, or support staff (U.S Department of Education, 2020). Without institutional investment, science classes may resort to minimal accommodation, leading to inequalities in academic outcomes.

9. **Social and Emotional Barriers**

   There is the issue of Peer Isolation, where in group projects, students with disabilities may be sidelined due to stigma or lack of awareness among peers, making them feel socially isolated during these group activities. This reduces their opportunities for collaborative inquiry.

   Low Self Efficacy is a result of Repeated academic failures or negative experiences in science which can reduce motivation and self- confidence in learners with disability (Garzotto, 2021).Students may thereby disengage, avoid participation, or even develop negative attitudes towards STEM subjects, reducing their future career aspirations in these fields.

Contemporary innovations in teaching science to students with special needs

Personalized and Adaptive Learning

One of the most promising innovations in science education for students with special needs is personalized learning**.** Using AI-driven platforms and adaptive learning software, educators can tailor science content to match each learner's cognitive level, learning style, and pace. These platforms adjust the complexity of scientific concepts in real time; ensuring students remain engaged without being overwhelmed.

Multisensory and Experiential Approaches

Science thrives on observation and hands-on experimentation. For students with disabilities, multisensory learning-engaging sight, sound, touch, and even smell can

bridge gaps in comprehension. Tactile Models, 3D- printed scientific tools, interactive simulations, and augmented reality (AR) environments allow students with visual, auditory or mobility impairments to interact with scientific phenomena in meaningful ways.

Universal Design for learning (UDL)

UDL principles advocate for multiple means of representation, expression and engagement. In science classrooms, this might involve:

- Visual diagrams paired with verbal explanations
- Sign language or captioned videos for deaf students
- Voice-to-text tools for students with dyslexia
- Simplified language or pictorial instructions for those with cognitive delays

Technology as an Enabler

Innovative technologies are central to revolutionizing special needs science education. Virtual and Augmented Reality (VR/AR) enables the child to explore complex systems like the solar system or the human anatomy. These technologies enable immersive learning experiences, particularly for students with autism spectrum disorders (ASD) and visual impairments (Garzotto (2021).

Assistive Tech: Tools such as speech –generating devices, eye-tracking systems and Braille displays facilitates active participation in science activities. Text-to-speech and speech-to-text technologies enhance scientific writing and comprehension for students with dyslexia or other language processing challenges (Bouck et al., 2021).

Game based learning platforms help to turn abstract concepts into interactive challenges, enhancing motivation and retention. These digital simulation and virtual lab tools offer safe, repeatable, and manipulable environment for students with motor or cognitive impairments (Al-Azawei et al., 2019). Advances in 3D printing have allowed the

creation of tactile learning materials in accessible models of scientific concepts, such as molecular structures and ecosystems (Morash et al., 2015).

Collaborative and Inclusive Teaching Models

Team teaching models involving special education experts, science teachers, and therapists promote a more holistic approach. Inclusive science classrooms that emphasize peer collaboration foster social skills empathy, and cooperative learning. Students of all abilities can participate in group experiments and problem-solving task with appropriate scaffolding. Facilitating scientific inquiry through guided questioning and tiered instruction has shown significant gains in conceptual understanding among students with intellectual disabilities (Kuo et al., 2020).

Culturally and Linguistically Responsive Practices

Students with Special needs often face additional barriers when instruction fails to reflect their cultural or linguistic backgrounds. Inclusive science education must incorporate diverse scientific contributions and support bilingual or multilingual learners through translated materials and bilingual aides.

Professional Development for Educators

Empowering teachers with training in inclusive science pedagogy, special education strategies and Technological fluency is essential. Continuous professional development ensures educators are equipped to meet the evolving needs of diverse learners.

Effect of innovations on academic outcomes for students with special needs

As accessibility and engagement increase, so does academic outcomes. Studies show that students with special needs who receive instruction through inclusive and adaptive methods demonstrate marked improvement in comprehension, retention and scientific reasoning (Okolo & Bouck, 2021). Differentiated instruction, aligned with state science

standard and individualised educational programs (IEP), allows students to progress at appropriate levels and achieve measurable learning goals.

In classrooms where technology is embedded into instructional design, teachers report higher test scores, improved scientific vocabulary, and better lab report writing skills among students with disabilities (Bouck et al, 2021). Also, the use of peer collaboration in inquiry –based settings has enhanced communication skills and teamwork, contributing to broader educational contributions.

7. **Improved Conceptual Understanding**

   Children with Learning disability most times battle with abstract scientific concepts, but tactile models, 3D printing, and virtual simulations have remarkably improved their ability to grasp the core ideas in biology, chemistry, and physics (Morash et al., 2015). Studies show that when students interact with hands-on or virtual representation of molecules, circuits, or ecosystems, they retain and apply information effectively (Bouck et al., 2021)

2 **Enhanced Scientific Inquiry and critical Thinking**

   Students are encouraged to hypothesize, experiment, and analyze outcomes-core skills in the scientific method with scaffold inquiry based learning. This method has been linked to improvement in higher –order thinking skills among students with cognitive disabilities (Kou et al., 2020).

3 **Increased Academic Confidence and Participation**

   Groundbreaking strategies often lead to increased student confidence in academic

   settings. Learners can access science content through their preferred modes (e.g., audio, visual, tactile), thereby helping them to participate more actively in

class discussions, labs and group projects (CAST, 2018). This often times results in better test scores and assignment completion rates.

4. **Better Performance in Standardized Assessments**

   Adaptive learning tools now allow students with special needs to prepare more efficiently for standardized tests. The use of practice platforms with built-in accommodations (e.g., audio instructions, simplified texts) has improved students readiness.

5. **Improved Scientific Communication and Writing**

   Tools such as Text-to speech and Speech – to Text has empowered students with dyslexia, ADHD, or fine motor challenges to articulate scientific ideas more clearly.

   These tools support the development of lab reports, research summaries, and presentations, thereby enhancing academic writing skills (Okolo & Bouck, 2021).

6. **Long-Term Academic path and STEM Aspirations**

   Garzotto (2021) observed that 68% of students with disabilities who used AR/VR tools in middle school science reported increased interest in pursuing further STEM (Science, Technology, Engineering, and Mathematics) learning opportunities. When students are included in and exposed to science education early, they are more likely to envision themselves in scientific roles, contributing to diversity in the field.

Conclusion

Revolutionizing science education for students with special needs is not just about access- it's about equity, empowerment, and excellence. By integrating innovation with empathy and evidence-based practices, we can create science classrooms where

curiosity thrives and every learner has the opportunity to become scientists in their own right. Historical progress has shown the challenges of teaching science to students with special needs, and that despite the progress made, science instruction remains under developed due to perceived incompatibility and hand-on learning and safety concerns as well as rigid text book reliance and limited use of multisensory strategies. Mention was made of the challenges of teaching science to students with special needs like, curriculum inaccessibility, instructional barriers, safety barriers, teacher training and assessment difficulty as well as social and emotional barriers. A few contemporary innovations in teaching science to students with special needs were also mentioned, such as, multisensory approaches, personalized and adaptive training and inclusive and collaborative teaching methods. Some effects of the innovation on academic outcomes mentioned but not limited to are, improved conceptual learning, enhanced scientific inquiry and critical thinking as well as increased academic confidence and participation and better participation and performance in standardized assessment. By continuing to adopt inclusive strategies, train educators, and invest in accessible technologies, we can fully realize the effect of innovations on academic outcomes and a future of noteworthy progress.

Suggestions

The following strategies can be examined to revolutionize science education for students with special needs:

i. Professional Development for Teachers: equip educators with training in inclusive pedagogy, UDL, and assistive technology integration.

ii. Policy Reinforcement: Strengthen mandates on inclusive curriculum design and resource allocation at both national and school levels.

iii. Collaborative Teaching Models: Encourage co-teaching between special education and science teachers to balance content knowledge and accessibility.

iv. Student Centred Design: involve students with disabilities in curriculum development to better address their learning preferences and ideas.

v. Research and Data Driven Practices: Promote ongoing research into effective, evidence-based practices in science education for diverse learners

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ARTIFICIAL INTELLIGENCE IN VISUAL ART EDUCATION: MERITS AND DEMERITS

By

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Abstract
The ever-changing landscape of technology in man's world has presented a transformative force that permeates various facets of human life. This recent technology, known as Artificial Intelligence (AI), is a highly effective and technologically advanced computer robot that is programmed to perform tasks undertaken by human brains. This unprecedented innovation, has brought tremendous advancements virtually in every field of human endeavor be it in Music, Arts, Medicine, Education, Architecture, Engineering, Transportation, Banking, to mention but a few. This paper focuses on this ground - breaking technology and its impact in the teaching and learning of visual art. In this regard, it examines the conceptual meaning of Artificial Intelligence, its historical background, and the concept of Visual Art Education. The paper exploresh Artificial Intelligence as an alternative creative tool in visual art practice with emphasis on AI generated artworks. More importantly, it x-rays the positive and negative impacts of Artificial Intelligence in Visual Art Education. As part of its recommendations, the paper stresses the need for caution in the application of artificial intelligence in visual art education so as not to subdue inherent human skills, creativity and self- expression or worse still, subject them to extinction.
Key Words: Artificial Intelligence, Demerits Merits Visual Art Education.

Introduction

Artificial Intelligence is increasingly discussed as a radical force that will change every aspect of human life. Also known as AI, Artificial Intelligence is reshaping the landscape of education, ushering in a new era of innovation and transformation (*e* School News 2024)**.** It is a powerful stimulus that has enhanced teaching and learning with recorded significant outputs. Buttressing this point, Alneyadi, Waedat and Alshamag (2023)**,** affirm that Artificial Intelligence, has transformed the traditional education paradigms by revolutionalising the way we learn, making it more personalised, engaging and efficient. It has the capacity to address some of the significant challenges in present day education, guarantees innovative teaching and learning as well as accelerates the required progress for the attainment of Education Social Development Goals.

Its emergence has initiated what could be described as industrial revolution within the creative industries significantly disrupting the traditional method of visual art education. For years, teaching and learning of visual art, has been anchored in the development of manual dexterity, the mastery of physical media and the lone genius model of individual expression. The emergence of Artificial Intelligence has changed focus from the physical act of creation to the conceptual act of prompting forcing educators to reconsider the very definition of artistic skill.

Artificial Intelligence in visual art education, implies highly technological innovations that are integrated in the teaching and learning of visual art. It is the use of AI algorithms and technologies to generate or enhance visual artworks such as paintings, sculptures, ceramics, graphics, textiles, photographs and digital art. These innovations in visual art education can bring inevitable multiple risks that can outpace policy debates and regulatory framework. In view of this, the need to adopt the principles of inclusion and equity in the use of visual art to harness the potentials of AI for the attainment of educational goals becomes imperative.

This paper will examine the conceptual meaning of Artificial Intelligence, its historical background and the concept of visual art education. Emerging trends of Artificial Intelligence in visual art with emphasis on AI generated artworks will be brought to focus while selected art technologies used in the creation of artworks and their specific functions will be analysed. More importantly Artificial Intelligence will be critically examined with greater emphasis on its impact in visual art education, highlighting the opportunities and challenges it offers to the creative field of art.

The Concept of Artificial Intelligence

The fundamental idea behind Artificial Intelligence is the ability of a digital computer or computer-controlled robot to perform tasks associated with intelligent beings (Copeland,2019). Though multiple definitions of Artificial Intelligence exist, this paper will throw light on some definitions from different authors and sources. Artificial Intelligence, is the branch of computer science which makes computers mimic human behaviours to assist humans for better performances in the field of science and technology. Replicating human intelligence, solving knowledge intensive tasks, building machines which can perform tasks that require human intelligence, creating some systems which can learn by itself are the fat specific goals of AI (Gosh & Arunchakam 2019). Artificial intelligence is a scientific and technological innovation that is basically designed to function like humans. It deals with helping machines in finding solutions to complex problems in a more human-like fashion by borrowing characteristics from human intelligence and applying them as algorithms (a set of rules, instructions designed to solve a specific problem, perform a particular task or optimise a process in a computer friendly way).

In another literature but in a similar perspective, Singh (2019), posits that Artificial Intelligence is a computer program, designed to solve complex problems by implementation of processes similar to human cognition. It is an area of computer science where intelligent machines and software are created. This area of research is based on the claim that a fundamental human trait, intellect (the knowledge of Homo Sapiens) can be so accurately defined, such that computers would replicate it. Also, NACOS ADSU (2024) in a similar view affirmed that Artificial Intelligence is a way of making a computer, a computer - controlled robot and a software think intelligently in a similar manner intelligent people think.

In summary, Artificial Intelligence is a scientific innovation meant to develop computer systems that can store knowledge like human brains and effectively use the knowledge also like humans to help solve problems and accomplish tasks. It is multi-purpose technology that can be applied in lots of different ways to many scenarios**.**

Historical Background of Artificial Intelligence

The idea of a machine being able to function on its own is ancient. Artificial intelligence appears to be a recent development but its groundwork started in the early 1900s in Greece (Tableau Software, 2024). Artificial intelligence originated from ancient philosophers who addressed questions that revolve around death and life. In the same

ancient period, scientists created things called automatons. 'Automaton', is an ancient Greek word that means "acting of one's will". These automatons were mechanical and moved independently without human assistance. One of the earliest records of automatons was invented in 400 BCE and refers to a mechanical pigeon created by a friend of the philosopher, Plato. Many years later in the year 1945 to be precise, Leonardo da Vinci (1452-1519) a renowned artist, musician, scientist and inventor created one of the most famous automatons. (Tableau Software 2024).

However, the historical perspective of Artificial Intelligence cannot be complete without the mention of Allan Turing. A celebrated British scientist, Alan Mathison Turing (1912-1954) was a mathematician and logician of the early 20th Century whose work made tremendous advances in computer science, artificial Intelligence and cryptography (Johnson & Griffin 2023). Turing is credited with the Church – Turing Thesis, which says that every math problem that is computable by humans can also be computed by the universal machine, which is essentially a mathematical algorithm containing the fundamentals of today's computing (Johnson & Griffin 2023).

In the year 1950, Turing made a significant impact on computers through his publication of a seminal paper titled; 'Computing Machinery and Intelligence' which introduced the 'Turing Test' (Bamford, 2023). The Turing Test explored a method of determining if a machine could be considered intelligent by its ability to engage in conversation indistinguishable from humans. Basically, the Turing Test was designed to explore machine intelligence.

Turing's work laid the groundwork for modern artificial intelligence and cognitive studies. His paper presented a test, where a human interrogator interacts with both a computer and a human, attempting to identify which is which, based on their responses. He maintained that if the computer can convincingly mimic human conversation, it could be considered to possess intelligence. Turing's Test and his entire work on computing machinery were foundational to the field of Artificial Intelligence (AI). Exploring the potentials of machines to think and learn, Turing, set the stage for future AI developments since then and for decades, Artificial Intelligence (AI) has been at the center stage in the science world (Bamford, 2023).

The term artificial intelligence was first coined in 1956 by John Mcarthy at Darthmouth College in Hanover, New Hampshire USA when he held the first academics conference on the subject. (Smith, 2006). It was a research project on AI that marked a seminal event in the history of Artificial Intelligence. Recent advancements in Artificial

Intelligence began in the twenty - first century when computer scientists started creating algorithms and software that could perform tasks that ordinarily need human intelligence, like problem solving, pattern recognition and judgement**.** The foundation for modern Artificial Intelligence was laid in the 1950's with two key milestones (Alan Turing's Test – 1950 and Dartmouth Conference- 1956). One of the earliest known pioneers of AI in this period was Alan Turing who proposed the concept of a machine that could stimulate any human intelligence task known as the Turing test (Kaur, 2023). The historic strides by engineers and scientists in the development of modern-day AI as chronologically presented by Kaur (2023), are highlighted as follows:

- **1950 Alan Turing's Turing Test:** a test developed to determine whether a machine is capable of thinking like a human being.
- **1956 Darthmouth Conference:** This conference was significant in the history of AI. It was a converging point for academics from various professions to examine the prospects of constructing robots that can think.
- **1960s and 1970s:** During these periods, the focus of AI research shifted to developing systems designed to mimic the decisions made by specialists in specific fields especially in fields like medicine, engineering and finance.
- **1980s:** This marked the period when AI research began to give attention to machine learning, a branch of the discipline that uses statistical methods to enable computers to learn from data. This led to the creation of neural networks that were modelled after the human brain structure and operation.
- **1990s and 2000s:** Remarkable achievements were made in the 1990s in robotics computer vision and natural language processing. Advances in speech recognition, image recognition and natural language processing were made possible by the advent of deep learning. (a branch of learning that uses deep neural networks).
- **2020s- Modern Day AI:** The present-day AI is remarkably evident in virtually every field. Visual assistants, self- driving cars, medical diagnostics, art

creating robots and some others. However, there has been a shift towards more human-like interactions with voice assistants. Natural language processing has also made significant progress enabling machines to understand and respond to human speech with increasing accuracy.

Emerging Trends of Artificial Intelligence in Visual Art

Significant achievements have been made in the world of visual art using Artificial Intelligence. In 2018, a painting called "Edmond de Belamy", was sold at Christe's auction house in New York for $432,500 (USD). See Fig 1. It was created with AI, after being trained on many images of portraits from the 18th and 19th centuries and was the first piece of AI art sold at auction. The sale sparked a significant debate about the future role of humans in creative professions such as art and digital media with the emergence of AI generated creative content. In 2022, a museum in the Hague (Netherlands) loaned the world's famous 'Girl with Pearl Earring' (c,1665) in Fig 2, by Johannes Vermeer to an international exhibition and temporarily replaced it in their gallery with an AI inspired version created by Berlin - based digital artist Julian van Dieken entitled 'My Girl with A Pearl' with many visitors to the gallery believing it was a real painting (Firtina 2023). Undoubtedly this was a landmark achievement by Artificial Intelligence in the field of painting,

In April 2023, the German artist Boris Eldagsen won the 2023 Sony World Photography Award with an image entitled Pseudomnesia, (the Latin word for fake memory). See Fig 3. The price was rejected after it was revealed that it was created by AI (Quresh 2022). These artworks show how far AI creative technology has advanced in only a few short years, from an ability to generate low quality AI portraits in 2018 to high quality AI paintings and photorealistic AI images today. Both the *Girl with Pearl Earring* and Pseudomnesia images were created with AI software that is now available to everyone online and is partly why AI has taken off with the public in 2023 enabling many of us to become potential artists**.**

Furthermore, in the area of sculpture, the world's first AI sculptural piece, *Impossible Statue,* shown in Fig 4, was created based on the analysis of works of Michelangelo, August Rodin, Kathe Kollwitz, Takamura Kotaro and Augustus Savage. The dynamic off balance poses of Michelangelo, the musculature and reflectiveness of August Rodin, the expressionist feeling of Kathe Kollwitz, the focus on momentum and mass

embodied in the work of Takamura Kotaro and the deviance in the figures of Augusta Savage (Sharp,2023).

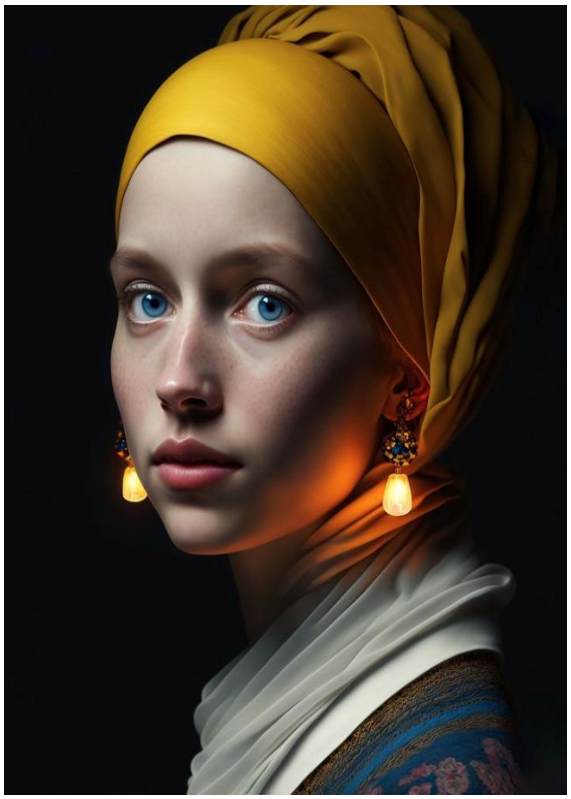

Fig. 1: *Portrait de Edmond Belamy. 2018*-Painting

Fig.2: Julian Van Dieken- *A Girl with Pearl Earing*

Created with AI Program (GAN) by Hugo Caselles- Dupre, Pierre Fautrl & Gauthier Vernier. Https://news.artnet,com> market

Fig. 3: Boris Eldagsen –*Pseudomnesia* 2023, Photograph created with AI Program - Electrician. (Stable Diffusion https://www. the guardian. com. Interpreters & New

2022 Painting, Created with AI Program (Midjourney) https://www.smithsoniaanmag.com> smart

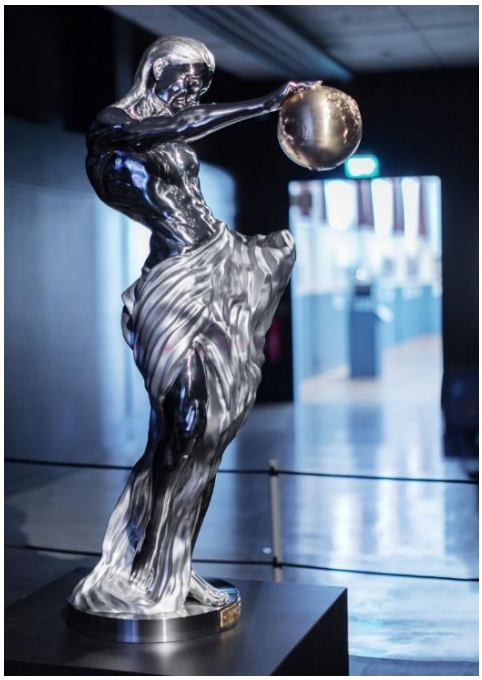

Fig. 4: Sandvick & AI – *The Impossible Statue* on display in National Museum Stockholm created with AI Programs DALL-E, Mid- Journey,3D

Proprietary Tools.

https://www.homesandvik>Home> Stores

The Concept of Visual Art Education

Visual art education refers to the instruction and learning experiences that focus on visual arts, encompassing various forms, such as drawing, painting, sculpture, photography and digital media. This educational discipline fosters creativity, critical thinking and aesthetic appreciation. It involves teaching fundamental artistic techniques, art history and encouraging students to express themselves through visual means. Visual art education plays a crucial role in developing cognitive and motor skills, enhancing cultural awareness and nurturing individual expression. Through hands on activities, students explore their artistic potential, learn to analyse, interpret visual information and gain a deeper understanding of the role of art in society. (Preston, 2024**).**

Visual Art is an integral aspect of art education that encourages students to explore their skills, creativity, imagination, thoughts, emotions and stories in visual forms. It enables students to develop practical skills and also guides them to explore those skills creatively to achieve appreciable visible artworks.

Artificial Intelligence in Visual Art Education

Though art is anthropocentric, there have been persistent calls by researchers for art educators to redirect the teaching and learning of art to the emerging non-human artificial intelligence technologies that are developed for art education. The recent AI art technologies are meant to be utilised in the classrooms to determine how they can be applied to students' skills and creativity from kindergarten to the primary level and higher education. However, it was discovered that students and their teachers, use programs like ChatGPT (a text-based AI interface that can respond, reason, problem solve, learn and plan to communicate with its user), to help with their art whether developing creative artworks, making art presentations or writing art essays, art reports and art critiques (art history, aesthetics and theory of art) or respond critically, to creative art texts.

In a comprehensive analysis of the recent developments of artificial intelligence in art education. Black and Chaput (2024), state that visual art education is a broad aspect of art education. It includes a wide range of areas but the most important area is art making which has conventionally been humanistic. Teaching and learning of visual art entails drawing, painting, printing and sculpture. Other incorporated areas include, art history,

art critique and art aesthetics. Researchers are of the view that the scope and application of generative artificial intelligence is broad with the capacity to help both the teachers and the students in teaching and learning of art (Black & Chaput 2024). In view of this, a series of AI art technologies have been integrated in visual art teaching and learning with outstanding results. Various practical activities like drawing, painting, sculpting, designing and modelling can be done using AI computer robots. This has widened tremendously the boundaries of visual art education in terms of content, technique, material and style.

Types of AI Art Technologies Used in Visual Art Education

Various aspects of visual art education are recently explored using various AI art technologies. The various areas of visual art and the emerging AI technologies are highlighted below:

Digital Painting and Drawing:

1. **Adobe Fresco:** It is an AI art technology that is used to mimic traditional painting and drawing techniques. It is a powerful free drawing and painting app designed for digital artists. Adobe Fresco offers a wide range of tools and features like: thousands of brushes, animation, layering, photo editing and cloud syncing.
2. **Prism: Prism** is a photo editor app that transforms images into artworks using AI. It transforms photos into works of art in the style of famous artists like Van Gogh and Picasso. Prism offers various features such as: art filters, image transformation, customisation, background editing and subscription model.
3. **Deep Dream Generator**: It is an app that uses AI to generate surreal and dream-like images. Deep Dream Generator applies a neural network algorithm to identify and enhance patterns resulting in trippy and artistic visuals.

Art Generation and Manipulation:

1. **GAN Breeder:** enables users to generate and manipulate original artwork using Generative Adversarial Networks (GANs). It helps users to generate art by creating unique evolving artwork using AI.

2. **Artbreeder:** It is an AI powered app that makes it possible to create and modify images through a process called breeding. Breeding is a technique used in generative models particularly in evolutionary logarithms and genetic algorithms. Artbreeder generally enables users to create and evolve original artwork using a combination of AI and user input.
3. **Stable Diffusion**: Stable Diffusion is an open-source generative AI model that creates photorealistic images from text and image prompts. It is a text-to -image model that uses diffusion techniques to generate high-quality images with impressive detail and realism.

Virtual Sculpting and Modelling

1. **Tinker cad:** Tinker cad is an Al free web-based 3D modelling tool that is used for design and creation. It is perfect for beginners, educators and hobbyists and offers a range of features like: block-based modelling, shape manipulation. Import/ export, circuit stimulator and code editor.

2. **SculptGL:** It is a web-based 3D sculpting tool that enables users to create and shape 3D models in a virtual environment. It consists of dynamic topology, sculpting tools and multi-resolution sculpting, vertex painting and import export.

Art Analysis and Critique

1. **Artendex:** Artendex is an AI - powered tool that analyses artworks and provides insights into composition, colour palette and style. It offers features like: artist database, art movement exploration and artwork showcase.
2. **DeepArt:** DeepArt uses AI to transform ordinary photos into artistic masterpieces by applying styles from renowned artists using neural networks. It analyses and critiques artworks, providing feedback on composition, colour and more.

(Meta AI Assistant, provided the information on Types of AI Art Technologies used in Visual Art Teaching and Learning, Oct 27, 2025).

Advantages of Artificial Intelligence in Visual Art Education

There could be no doubt that Artificial Intelligence has become a significant phenomenon in the academic and creative world. Emphasising the importance of AI in visual art, Winey (2024)**,** states that AI can be a great tool for creating individual elements in art. It is best and most ethically used when it is used to create individual

elements not whole designs. In another literature, Holistic SEO (2023), opined that AI in art and creativity is important because of its ability to inspire innovations and push the boundaries of artistic expression. It brings new techniques, tools and perspectives to the creative process, opening up explored avenues for artists and creators. Artists break free from conventional methods and explore new ways by incorporating AI in the creative process. Artificial Intelligence brings interdisciplinary collaboration and exchange of ideas between artists, technologists, scientists and researchers. The cross pollination of knowledge and expertise, Holistic SEO (2023) further notes, brings innovative expertise that fuse artistic expressions with technological advancements, driving fields forward. On a broader perspective, the importance of artificial intelligence in visual art education are x-rayed as follows:

i. **Expansion of Artistic Horizon:**

Artificial Intelligence can help visual art students explore new ideas and develop their creativity**.** The integration of AI into the artistic workflow, blurs the traditional boundaries between technology and classic creative methods. In generative art (a combination of art, design and technology) for instance, AI can create algorithmic paintings by generating unique and algorithmically created paintings that blend styles, colours and patterns. In fractal art (a field that combines art, mathematics and beauty), it has the creative ability to generate intricate self- similar patterns using fractal geometry, leading to stunning visual effects. AI also facilitates neural style transfer in visual art education by enabling the transfer of style of one image to another, creating fascinating fusions of different artistic styles. AI encourages collaborative creativity in visual art through Human- AI- Creation that enables art students in generating new ideas, exploring different styles or completing unfinished works (Chi. 2024).

ii. **Personalised Learning**

The realm of education as Khan & Jian (2023) rightly note is witnessing a transformative integration with Artificial Intelligence poised to redefine the contours of pedagogical strategies. Central to this transformation is personalised learning experiences where AI tends to tailor educational content to resonate with an individual's unique needs, preference and pace (Khan & Jian 2023). Affirming thi**s,** Kshitij et.al (2019), submits that AI -powered adaptive learning systems, adjust to individual students' needs, skill levels and learning styles.

iii. **Enhanced creativity:**

Art and creativity have long been considered as unique human endeavours, expressions of our emotions, imaginations and cultural identity. The advent of Artificial Intelligence has pushed the boundaries of creativity by introducing new dimensions of collaborations between humans and machines. The exploration of AI in art and creativity delves into the fascinating and evolving intersection where technology meets artistic expression, challenging traditional notions and inspiring fresh forms of creativity. (Egon, Russel & Julia 2023). It is pertinent to note that AI-assisted collaborative tools facilitate co- creation and feedback among art students, while AI-generated art prompts exercise, stimulates creativity and new ideas.

iv. **Improved Technical Skills**

AI based tutorials and demonstrations, provide step-by-step guidance on techniques and skills (Wang et. al, 2019). Its powered critique systems offer constructive feedback on composition, colour, and proportions. AI can significantly enhance technical skills using virtual painting simulators. AI – powered stimulators can mimic traditional painting techniques, allowing students to practice and experiment with different styles and mediums. In drawing for instance, AI drawing and sketching software can provide real-time feedback on proportion, anatomy, perspective, helping students improve their technical skills. More so through colour theory and palette analysis, AI can analyse colour palettes and provide suggestions for harmonious colour combinations, teaching students about colour theory and its applications.

v. **Art Historical Analysis**

The constant quest for new ways to organise and analyse the vast amount of information related to our artistic heritage has always been the major preoccupation of art historians. One authentic solution is to use Artificial Intelligence as a tool to study and manage historical facts. AI algorithms can analyse art pieces for style, technique and even brush strokes helping in categorising and understanding artworks. This can help in attributing artworks to specific artists especially in cases where the authorship is uncertain (Shafe 2023)**.**

Negative Effects of Artificial Intelligence in Visual Art Education

Artificial intelligence is insentient. It is designed to reproduce artistic styles and forms but it cannot understand or express emotions like humans. Art created by artificial intelligence could lack the emotional depth and nuance that characterise human art.

Artificial Intelligence as an alternative instrument for teaching visual art, among others has the following negative impact:

i. The creative process may be subdued due to over dependence on AI-generated images. This may hamper students' ability to develop their artistic voices and practice the skill of ideation (ideation is the process of generating, developing and communicating new ideas).
ii. The imagery created with artificial intelligence often prioritises efficiency and speed. It undermines the importance of hands- on artistic practices and technical skills in visual art education.
iii. Though visually appealing artworks can be created using AI algorithms, such artworks lack the human emotional and conceptual depth that characterise traditional art forms.
iv. The adoption of AI in visual art teaching and learning, raises serious concerns about the authenticity of artistic expressions and the ideation process.

Suggestions

1. Traditional skills in art should not be undermined in the use of Artificial Intelligence in the teaching and learning of visual art . There is a need to maintain traditional skills in art. In this regard, art educators should stick to a strong foundation in traditional artistic skills.
2. Artificial Intelligence, should be used responsibly in art education bearing in mind the need to safeguard intellectual property rights of artists. In view of this, school administrators should organise regular symposiums, conferences workshops and art exhibitions for art educators and art students to create awareness on the essence of individual creativity in art and the need to protect intellectual property rights of creators and artists in the course of using AI.
3. Following the overwhelming influence of Artificial Intelligence in visual art education, the government through its education policy makers and curriculum planners should implement policies to back the setting up of authorised bodies that will ensure regular and periodic orientation of stakeholders (art educators and art students) on the ethical

use of Artificial Intelligence especially as it becomes more intrusive within the art making process.

Conclusion

Artificial Intelligence appears to be a recent scientific innovation but it is ancient having derived its root from Greece as far back as 19O0. Though the idea that evolved into the present-day technology known as Artificial Intelligence came into existence as far back as 1900, its prominence came to limelight in the 1950s with Alan Turing's Turing Test of 1950 and the Dartmouth Conference. The concept of Artificial Intelligence from various perspectives revolves around a computer robot that is designed with human intelligence to perform tasks like humans. In Visual Art Education, AI art technologies have been developed and designed with the ability to recreate artworks created by humans in the areas of painting, photography, sculpture, drawing among others. Artificial Intelligence in Visual art education means art programs that are designed for teaching and learning of art. Their integration into visual art education has positive and negative effects. The positive effects among others include expansion of artistic horizon, enhancement of personalised learning, enhancement of creativity and improved technical skills. On the negative side, Artificial Intelligence (AI) undermines creativity and art created with Artificial Intelligence lacks human and emotional depth that characterise traditional art forms. It undermines authenticity of artistic expression. This paper entitled *Artificial Intelligence in Visual Art Education: Merits and Demerits,* conceptually and historically explored Artificial Intelligence, its potential as an art educational creative tool but more importantly its positive and negative effects in visual art education.

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EXPLORING NEW METHODS AND TECHNOLOGIES IN LANGUAGES

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Abstract

*This study examines the integration of new methods and technologies in social science and language research, highlighting the shift from traditional approaches to computationally enhanced methods. It explores how digital technologies such as natural language processing, machine learning, and artificial intelligence are reshaping research practices and knowledge production. Using **Actor-Network Theory**, the study shows how technologies act as active participants in research networks, influencing methodology, data collection, and interpretation. While challenges such as the digital divide, algorithmic bias, ethical concerns, and slow institutional adaptation persist, the study identifies major opportunities for improved data analysis, global collaboration, and innovative research methods. The **COVID-19 pandemic** accelerated the adoption of digital approaches, demonstrating both the need for and feasibility of technologically supported research. Overall, technological integration offers significant potential for advancing understanding of human behavior, communication, and social processes in the digital age.*

Keywords: digital humanities, computational social science,

Introduction

The landscape of social science and language research has been transformed by advances in computational technologies and digital methodologies. This shift reflects not only improved research tools but also a fundamental change in how scholars study human behavior, communication, and social patterns through interdisciplinary approaches combining computational analysis with humanistic inquiry. A major aspect of this transformation is the use of natural language processing (NLP) and machine learning to analyze large volumes of textual data such as social media and historical documents. In African contexts, these technologies are particularly valuable because of the continent's linguistic diversity (Adebara et al., 2024). However, despite Nigeria's large research system—nearly 200 universities and over 60,000 academic staff—research output remains relatively low, highlighting the need for stronger methodological innovation (Aiyar et al., 2021).

Technological developments have also influenced language education and linguistics in Nigeria by supporting multilingual education and enabling digital humanities methods such as corpus linguistics and network analysis (Okechukwu & Nneka, 2024). The COVID-19 pandemic further accelerated digital adoption in tertiary institutions, promoting remote data collection and virtual research methods (Okwu et al., 2023). Despite these opportunities, challenges such as limited digital infrastructure, uneven internet access, and the digital divide remain. Nevertheless, integrating digital and computational methods offers Nigeria an important opportunity to strengthen research productivity and contribute more effectively to global knowledge production.

Statement of the problem

Social science and language research face growing challenges as traditional methodologies become insufficient for addressing the complexity and scale of modern

digital interactions. The expansion of online communication has generated vast amounts of textual data from social media and digital platforms, which conventional methods such as manual content analysis cannot efficiently process. This limits researchers' ability to analyze large-scale social trends and linguistic patterns. Language researchers also encounter difficulties studying multilingual communities, language change, and cross-cultural communication in rapidly evolving digital environments. These challenges are greater when documenting linguistic diversity or endangered languages, where efficient data collection and analysis are essential. The **COVID-19 pandemic** further exposed weaknesses in research methods that rely on face-to-face interaction, highlighting the need for remote data collection and virtual research approaches. At the same time, the digital divide continues to affect research accessibility and representation, particularly in regions with limited technological infrastructure. Additional challenges include limited training in digital research tools, barriers to interdisciplinary collaboration, concerns about bias and reliability in automated methods such as machine learning and natural language processing, and unresolved ethical issues related to digital data use and privacy.

Conceptual framework

Concept of Digital Transformation in Social Sciences and Languages

The concept of digital transformation in social sciences and language studies has gained increasing attention as technological innovations reshape research, teaching, and communication. Scholars emphasize its multidimensional nature and its impact on how knowledge is produced and shared. Eze et al. (2021) define digital transformation as the integration of digital technologies into academic processes, fundamentally changing how knowledge is created and used. Similarly, Iwu, Nze, and Madu (2022) describe it as the shift from traditional manual research methods to digital tools that improve the

speed and scalability of data collection and analysis, including the use of software such as NVivo and SPSS.

In language education, Okonkwo and Garuba (2024) highlight the role of artificial intelligence and natural language processing in supporting language learning and multilingual communication, while Yahaya and Bello (2022) emphasize digital instructional tools such as virtual classrooms and mobile learning applications.

From a policy perspective, Mohammed and Tanko (2023) view digital transformation as institutional restructuring that promotes digital literacy, equitable access to technology, and sustainable digital infrastructure. Overall, digital transformation involves rethinking how knowledge is produced, taught, and applied, with implications for research methods, curriculum design, and educational equity.

Concept of methodological innovation

The concept of digital transformation in social sciences and language studies has gained increasing attention as technological innovations reshape research, teaching, and communication. Scholars emphasize its multidimensional nature and its impact on how knowledge is produced and shared. Eze et al. (2021) define digital transformation as the integration of digital technologies into academic processes, fundamentally changing how knowledge is created and used. Similarly, Iwu, Nze, and Madu (2022) describe it as the shift from traditional manual research methods to digital tools that improve the speed and scalability of data collection and analysis, including the use of software such as NVivo and SPSS. In language education, Okonkwo and Garuba (2024) highlight the role of artificial intelligence and natural language processing in supporting language learning and multilingual communication, while Yahaya and Bello (2022) emphasize digital instructional tools such as virtual classrooms and mobile learning applications. From a policy perspective, Mohammed and Tanko (2023) view digital transformation

as institutional restructuring that promotes digital literacy, equitable access to technology, and sustainable digital infrastructure. Overall, digital transformation involves rethinking how knowledge is produced, taught, and applied, with implications for research methods, curriculum design, and educational equity.

New methods and technologies in social science and language studies

The integration of digital tools and research innovations has significantly transformed teaching, learning, and data analysis in social sciences and language studies. In Nigeria, scholars increasingly adopt new technologies and methodologies to address contemporary educational and research challenges.

Digital ethnography or virtual fieldwork involves conducting research in online environments such as WhatsApp, Facebook, and TikTok to study social behavior and youth culture. This method enables researchers to reach populations that may be difficult to access physically and has become more important in post-pandemic research (Ojo & Adekunle, 2021; Usman & Ibrahim, 2022).

Mixed-methods and interdisciplinary research combine quantitative approaches such as surveys with qualitative methods like interviews and observations. This approach helps researchers analyze complex social issues, including gender-based violence, education inequality, and regional development.

Big data analytics uses advanced computing tools to analyze large datasets from sources such as national statistics, social media, and mobile networks. It has been applied to areas such as monitoring electoral misinformation and analyzing voter sentiment online (Ibrahim & Yusuf, 2022).

In language studies, **corpus linguistics** analyzes large text collections to identify language patterns, such as code-switching among bilingual speakers (Arowolo & Chukwu, 2021).

Natural language processing (NLP) applies artificial intelligence to language analysis and supports indigenous language preservation and educational tools (Balogun & Ayeni, 2020; Okafor & Danjuma, 2023). Digital tools also support education through

AI-powered writing assistants, **learning management systems (LMS)** used for virtual teaching, and **mobile-assisted language learning (MALL)** applications that improve vocabulary and language acquisition. Overall, these technologies are expanding research opportunities and strengthening teaching and learning in Nigeria's social sciences and language education.

Advantages and disadvantages of each method

The integration of digital tools and research innovations has transformed teaching, learning, and data analysis in social sciences and language studies in Nigeria. Scholars increasingly adopt new technologies and methodologies to address contemporary research and educational challenges.

Digital ethnography or virtual fieldwork allows researchers to study social behavior in online environments such as social media platforms, making it easier to access dispersed populations (Ojo & Adekunle, 2021; Usman & Ibrahim, 2022). Mixed-methods research combines quantitative surveys with qualitative interviews to analyze complex social issues. Big data analytics enables the analysis of large datasets from sources such as national statistics and social media to study trends like electoral misinformation (Ibrahim & Yusuf, 2022). In language studies, corpus linguistics and natural language processing help analyze language patterns and support indigenous language preservation (Arowolo & Chukwu, 2021; Balogun & Ayeni, 2020; Okafor &

Danjuma, 2023). Digital technologies also enhance education through AI-powered writing tools, learning management systems for virtual teaching, and mobile-assisted language learning applications. Overall, these innovations are expanding research possibilities and strengthening social science and language education in Nigeria.

Theoretical framework

Core Principles of Actor-Network Theory

Actor–Network Theory (ANT) reconceptualizes social actors and technology as interconnected "actors" within networks, distributing agency across humans, technologies, institutions, and objects. It challenges the traditional separation of society and technology, emphasizing their joint role in shaping social processes. Key concepts include symmetry (analyzing human and non-human actors equally), translation (negotiation of interests), and enrollment (assigning roles), with knowledge emerging from actor interactions. ANT is relevant to social science and language research as it views digital tools—such as NLP, machine learning, corpus linguistics software, and language-learning apps—not merely as instruments but as active participants shaping research questions, methods, and outcomes. It explains the rise of interdisciplinary fields like digital humanities and computational linguistics, the adoption of technologies, and phenomena like "black boxing." The theory also informs analysis of ethical and social issues, including the digital divide, algorithmic bias, and data privacy, offering a framework to understand the impact of technology on knowledge production.

Contemporary applications and future implications

Actor–Network Theory remains relevant in the digital age by framing emerging technologies—such as large language models, virtual reality, and AI—as active participants in knowledge production rather than mere tools. The theory also highlights

the importance of navigating complex human–technology networks for successful interdisciplinary collaboration in digital humanities and computational social sciences.

Conclusions

The integration of digital technologies and computational methods is transforming social science and linguistics, representing a paradigm shift rather than a simple enhancement of traditional research. Traditional methodologies are increasingly insufficient for addressing complex social phenomena, large digital datasets, and evolving human behavior in online environments. Fields like computational social science, digital humanities, and technology-enhanced language research bridge this gap. Actor–Network Theory highlights that technologies function as active participants in knowledge production, with successful integration depending on understanding relationships among human researchers, technological systems, institutions, and research subjects. Challenges include the digital divide, algorithmic bias, data privacy, and gaps in researcher training and institutional adaptation. Opportunities arise from natural language processing, machine learning, and virtual/augmented reality, enabling analysis of large datasets, enhanced language learning, and global collaboration. The COVID-19 pandemic accelerated digital adoption, demonstrating the feasibility of hybrid approaches that combine traditional and digital methods while revealing areas for further development.

Recommendations for academic institutions

Academic institutions must take proactive steps to support the integration of new methods and technologies in social science and language research. Universities should establish interdisciplinary research centers that bring together social scientists, linguists, computer scientists, and data specialists to foster collaboration and knowledge exchange. These centers should provide training programs that help researchers

develop the technical skills necessary to implement computational methods while maintaining theoretical rigor and disciplinary expertise.

Institutions should invest in robust technological infrastructure, including high-performance computing resources, secure data storage systems, and reliable internet connectivity. This infrastructure should be accessible to researchers across all departments and career stages, with particular attention to supporting early-career researchers who may lack independent funding for technological resources. Academic institutions should also revise their curriculum to include training in digital literacy, computational methods, and data science for social science and language students. This training should be integrated throughout degree programs rather than relegated to optional courses, ensuring that all graduates possess the skills necessary to engage with technological tools in their future research and professional practice.

Recommendations for researchers and scholars

Researchers must embrace lifelong learning approaches to keep pace with rapidly evolving technologies. This includes participating in professional development workshops, online courses, and collaborative learning communities focused on digital research methods. Researchers should seek opportunities to collaborate with colleagues from different disciplines, recognizing that the most innovative approaches often emerge from interdisciplinary partnerships.

Social scientists and language researchers should develop critical perspectives on technology that allow them to evaluate the strengths and limitations of different tools and methods. This includes understanding the assumptions embedded in algorithms, recognizing potential sources of bias, and maintaining awareness of ethical implications in technological research. Researchers should also prioritize transparency and

reproducibility in their use of digital methods. This includes documenting computational procedures, sharing code and data when possible, and clearly explaining the role of technology in research findings. Such practices will help build trust in computational approaches and facilitate the advancement of the field.

Recommendations for funding agencies and policy makers

Funding agencies should prioritize support for interdisciplinary research projects that combine social science or language research with technological innovation. Grant programs should explicitly encourage collaboration between humanistic scholars and technical experts, providing funding structures that support team-based research across institutional and disciplinary boundaries.

Policy makers should address the digital divide by investing in technological infrastructure and ensuring equitable access to digital resources. This includes supporting community-based research initiatives, providing technology access in underserved areas, and creating policies that protect data privacy while enabling legitimate research activities. Funding agencies should also support the development of open-source research tools and platforms that can be freely accessed by researchers regardless of their institutional affiliation or geographic location. This will help democratize access to advanced research technologies and promote global collaboration in social science and language research.

Recommendations for technology developers and industry partners

Technology companies and software developers should engage more actively with academic researchers to understand their specific needs and challenges. This collaboration should inform the development of research-oriented tools and platforms that balance ease of use with analytical sophistication.

Industry partners should support academic research through data sharing agreements, technical expertise, and funding for research that addresses societal challenges. However, these partnerships must be structured to maintain academic independence and ensure that commercial interests do not compromise research integrity. Developers should prioritize the creation of ethical AI and machine learning tools that include built-in safeguards against bias and privacy violations. This includes developing transparent algorithms, providing clear documentation of system capabilities and limitations, and enabling user control over data processing procedures.

Recommendations for professional organizations and academic societies

Professional organizations in social science and linguistics should update ethical guidelines to address challenges posed by digital research methods, including standards for data collection and analysis, algorithmic transparency, and protection of participant privacy. Academic societies should also create forums such as conferences, workshops, and publications to share best practices in technological research methods and encourage participation from researchers at different career stages and regions. In addition, professional bodies should promote technical standards that ensure interoperability among research tools and platforms, thereby reducing barriers to technology adoption and improving collaboration among researchers.

Recommendations for international collaboration

The global nature of digital technologies requires international cooperation to develop standards, share resources, and address common challenges. International research collaborations are essential for tackling cross-cultural and multilingual research questions that require diverse expertise. Funding mechanisms should support collaborative projects addressing global challenges through technological innovation, while ensuring participation from developing countries and equitable sharing of benefits. Global initiatives should also promote technological solutions for documenting and preserving endangered languages and cultures.

Future directions

The future of social science and language research will likely involve stronger integration between human expertise and artificial intelligence, the development of advanced multimodal analytical approaches, and the emergence of new ethical frameworks for digital research. Researchers and institutions that effectively address current challenges while embracing technological opportunities will be better positioned to contribute to this evolving field. Successfully navigating this transformation will require continued commitment from stakeholders to balance innovation with responsibility. This will help ensure that technological advances enhance rather than replace the critical thinking and interpretive skills central to social science and language research, ultimately improving understanding of human behavior, communication, and social processes.

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