SUSTAINABLE KNOWLEDGE

EDUCATION, OPENNESS, AND EVALUATION

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Neha VERMA

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PREFACE

This collection of chapters explores critical themes shaping education, sustainability, and scholarly communication in today's world. Each contribution offers a unique lens—personal, structural, and cultural—on how knowledge is experienced, shared, and evaluated.

The first chapter delves into student narratives on sustainability, revealing how personal reflection can deepen environmental awareness and inspire meaningful action. The second chapter challenges traditional academic publishing, advocating for open access as a more inclusive and forward-thinking model.

The final chapter brings a regional perspective to educational evaluation, highlighting practices and challenges within the Nigerian context. Together, these works invite readers to reflect, question, and engage with the evolving dynamics of learning and knowledge exchange.

Editoral Team
October 28, 2025
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CHAPTER 1
PERSONAL REFLECTIONS ON SUSTAINABILITY: A THEMATIC ANALYSIS OF STUDENT NARRATIVES

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INTRODUCTION

In an era marked by ecological crises and socio-political uncertainty, sustainability education must go beyond knowledge transmission to engage the whole person - cognitively, emotionally, and ethically. Sustainability is widely recognized as one of the defining challenges of our time. It encompasses not only environmental protection but also the pursuit of social justice, economic resilience, and intergenerational responsibility. Higher education has increasingly become a critical arena for addressing sustainability, as it prepares future leaders to navigate the complexities and ethical dilemmas inherent in the concept. Universities are therefore not only sites of knowledge transfer but also spaces where values, behaviors, and worldviews are shaped. Personal reflection has emerged as a particularly effective pedagogical tool in sustainability education. By asking learners to articulate what sustainability means to them, educators create opportunities for critical self-examination, identity formation, and the integration of values into professional and personal life.

Reflection also connects individual experience with broader societal and ecological systems, helping to bridge the gap between theory and practice. As Oxenswärdh (2017; 2021) has argued, reflection and collective learning processes support identity development and create conditions for long-term sustainable engagement. This chapter builds on students' reflective narratives to explore how sustainability is understood and enacted at the personal level. At the same time, it draws on broader research traditions - including studies of organizational and collective learning and sensemaking processes - to situate these reflections within a wider scholarly context. These perspectives highlight how sustainability emerges not only through individual reflection but also through collaborative meaning-making and the co-creation of values. By integrating these perspectives, this chapter highlights both the personal and the collective dimensions of sustainability learning and leadership. It argues that student reflections, when connected with insights from organizational and learning research, provide valuable lessons for how sustainability can be understood as a process of individual transformation, collective sensemaking, and value creation.

Theoretical Framework

This study draws upon five intersecting theoretical frameworks to interpret how students internalize and express sustainability through reflective writing: sustainability education, transformative learning, reflective leadership, collective learning, and sensemaking through value co-creation. Together, these strands form an integrated lens that acknowledges the complexity of sustainability as both a personal and systemic concern.

Sustainability Education

Sustainability education has evolved significantly over the past decades. Initially rooted in environmental education, it now integrates systems thinking, interdisciplinary learning, and values-based pedagogy (Sterling, 2001; Wals & Corcoran, 2012). It moves beyond knowledge transmission to foster the development of critical competencies, such as:

- Systems thinking (understanding relationships across ecological, social, and economic systems),
- Anticipatory competence (engaging with future scenarios),
- Normative competence (navigating values and ethical dimensions),
- Strategic competence (designing and implementing interventions),
- Interpersonal competence (collaborating across disciplines and cultures) (Wiek et al., 2011; Rieckmann, 2012).

Tilbury (2011) emphasizes that sustainability education must cultivate both agency and reflexivity, enabling learners to envision alternative futures and question dominant paradigms. Jickling and Wals (2008) also warn against treating sustainability as a "fixed outcome," instead advocating for it as a dynamic and contested concept embedded in cultural, political, and ecological contexts. This theoretical stance frames students not as passive recipients of sustainable norms, but as active co-creators of meaning and action.

Transformative Learning

Transformative learning theory (Mezirow, 1991) provides a critical lens for examining how deep learning occurs through reflection, especially in value-laden contexts like sustainability.

Central to this theory is the concept of disorienting dilemmas—experiences that challenge prior assumptions and trigger self-examination.

In sustainability education, these dilemmas often emerge from the confrontation with ecological crises, ethical tensions, or awareness of complicity in unsustainable systems (O'Sullivan, 2003; Taylor, 2007). Emotions such as climate anxiety, guilt, hope, and moral urgency become integral to the learning process, not peripheral to it (Dirkx, 2006).

What distinguishes transformative learning is not just cognitive change but affective and identity-level shifts. Students begin to see themselves differently—not merely as learners, but as ethical agents capable of shaping systemic change. Sterling (2011) frames this as a shift from transmissive to transgressive education, where learners critically interrogate worldviews and explore new ways of being in relation to others and the planet.

Reflective Leadership

Sustainability demands new modes of leadership that emphasize authenticity, vulnerability, and collaboration rather than control or charisma. Reflective leadership theories view leadership as a relational and ethical practice, rooted in awareness of self and responsiveness to context (Hargreaves & Fink, 2006; Maak & Pless, 2006).

This perspective aligns with values-driven leadership, where individuals act not just from positional authority but from internalized principles. Pless and Maak (2011) articulate responsible leadership as the ability to engage stakeholders in co-creating sustainable value, while Uhl-Bien (2006) highlights complexity leadership, which fosters adaptability and emergent learning in uncertain environments.

For students, reflecting on leadership in the context of sustainability becomes a way of rehearsing future ethical engagement. It allows them to integrate personal identity with systemic responsibility, moving from abstract ideals to embodied practices (Shrivastava, 2010).

Collective Learning and Communities of Practice

Learning for sustainability is not an isolated or individual endeavor - it is inherently collective.

Drawing from Wenger's (1998) theory of communities of practice, knowledge is co-constructed through shared language, experience, and action. Sustainability education often takes place within learning communities that simulate real-world complexity, where students must navigate diverse perspectives and tensions. Oxenswärdh (2017) builds on this by showing how collective learning fosters shared sensemaking, which is essential for grappling with the ambiguity and trade-offs of sustainability.

In this view, sustainability is not a static curriculum but an evolving conversation shaped by trust, dialogue, and reflection. Lozano (2014) adds that organizational settings - like universities - can institutionalize such learning by integrating sustainability across operations, governance, and pedagogy. In the classroom, this translates to pedagogical designs that encourage peer learning, interdisciplinary dialogue, and critical questioning.

Value Co-Creation and Sensemaking

Weick's (1995) concept of sensemaking underscores how individuals make meaning in complex, ambiguous situations. In sustainability education, where there are often no right answers, sensemaking becomes a vital process through which students interpret, reframe, and align their values with actions.

Oxenswärdh (2018) expands this into the domain of value co-creation, where meaning is not given but negotiated - between students, educators, institutions, and societal expectations. Freeman's (1984) stakeholder theory further supports this view by recognizing that sustainability emerges from dialogues among interdependent actors, each contributing perspectives and values.

Sustainability thus becomes not only a destination but a process of shared learning and evolving identity. Students' reflective writing reveals how they navigate tensions between idealism and pragmatism, between personal ethics and systemic inertia - demonstrating the centrality of narrative and reflection in value formation.

Synthesis

Together, these five theoretical strands reinforce an understanding of sustainability learning as multi-dimensional, identity-forming, and dialogic.

They recognize the importance of not only knowledge acquisition but also emotional engagement, ethical reasoning, collaborative meaning-making, and systemic vision.

This integrative framework supports a pedagogy of transformation, where students are not only informed but also transformed - learning to see sustainability as both a personal journey and a collective endeavor toward a more just and resilient future.

1. METHODOLOGY

This study employed a qualitative, interpretive research design to explore how students conceptualize sustainability through reflective writing. The dataset consisted of 120 written reflections submitted between 2021 and 2025 by graduate students enrolled in the course Leadership for Sustainability at Uppsala University. The assignment asked students to respond to the open-ended prompt: "What does sustainability mean to me?" Reflections ranged from 500 to 1200 words and were written as part of a pedagogical exercise designed to integrate theory with personal experience.

1.1 Participant Selection

All enrolled students were invited to submit a reflection as part of the course requirements. Out of approximately 180 students across five cohorts, 120 consented to have their anonymized texts included in the study. Reflections were selected for analysis based on the following criteria:

- The student had given informed written consent for research use.
- The text demonstrated sufficient depth and completeness to allow for interpretive analysis.
- The reflection addressed both personal and conceptual dimensions of sustainability.

The final sample included students from diverse disciplinary backgrounds, including environmental sciences, political science, engineering, education, and economics, reflecting the interdisciplinary nature of sustainability education. No demographic data were collected beyond academic program, in line with ethical considerations to protect participant anonymity.

1.2 Analytical Process

The reflections were analyzed using reflexive thematic analysis following Braun and Clarke's (2006, 2019) six-phase model. This approach was chosen for its flexibility and capacity to capture both semantic content and latent meaning in personal narratives. The analytical process unfolded in the following steps:

Familiarization

All texts were read in full by the lead researcher and two co-readers to gain an overall sense of tone, language, and emotional undertone. Initial memos were written to capture early impressions, tensions, and recurring motifs

Initial Coding

An open coding process was conducted in NVivo and manually. Codes captured references to values, systems thinking, contradictions, emotional states, ethical judgments, future-oriented thinking, and leadership aspirations. Codes were inductively derived from the data rather than imposed from theory.

Theme Generation

Through constant comparison and collaborative analysis, the codes were organized into potential themes. Thematic clusters began to form around concepts such as complexity, ecological awareness, emotions, daily practices, leadership, and identity transformation.

Theme Review and Refinement

Themes were iteratively reviewed and discussed among researchers, with constant movement between empirical data and theoretical perspectives. Overlapping or redundant categories were merged or separated depending on internal coherence and theoretical clarity.

Definition and Naming of Themes

Final themes were clearly defined to capture the essence of the students' meaning-making. Illustrative quotes were selected for each theme to ground interpretation in the participants' own voices.

Interpretive Synthesis

The final thematic structure was interpreted through relevant theoretical lenses, including transformative learning theory (Mezirow, 1991), systems thinking (Sterling, 2001), sensemaking (Weick, 1995), value co-creation (Oxenswärdh, 2018), and anticipatory competence (Wiek et al., 2011).

1.3 Emergent Thematic Categories

The analysis resulted in six overarching themes:

- Complexity and Uncertainty: The ambiguity of sustainability and its paradoxes.
- Awareness of Planetary Boundaries: Students' understanding of ecological thresholds.
- Ethical and Emotional Dimensions: Guilt, hope, responsibility, and moral framing.
- Everyday Sustainability Practices: Concrete behaviors and symbolic actions.
- Leadership and Influence: Aspirations to lead by example and mobilize others.
- Growth and Reflection: Identity shifts and transformation through reflective learning.

These categories reflect not only the cognitive aspects of sustainability learning but also the affective, ethical, and identity-forming processes that shape how students relate to sustainability challenges.

1.4 Ethical Considerations

This study was conducted in accordance with the ethical guidelines for educational research in Sweden (Vetenskapsrådet, 2017). Participation was voluntary and informed. All students were notified in advance that their anonymized reflections might be used for research purposes. Written consent was obtained separately from the course grading process to ensure voluntariness. No identifying information was collected, and all names and references to specific locations or individuals were removed during transcription.

Swedish-language reflections were translated into English using a process of back-translation and peer validation to preserve emotional nuance and cultural specificity. All researchers involved in the analysis signed confidentiality agreements. The study did not require ethical board approval under Swedish law, as it did not collect sensitive personal data or involve interventions. However, it adhered to principles.

2. FINDINGS AND THEMATIC ANALYSIS

Students consistently described sustainability as a complex and ambiguous concept. They reflected on paradoxes such as economic growth versus ecological preservation, individual responsibility versus systemic barriers, and technological optimism versus moral humility. This theme echoes Sterling's (2001) advocacy for systems thinking, where education embraces complexity rather than seeking reductionist answers.

Some students voiced a sense of paralysis when confronted with conflicting sustainability choices*: "Should I stop flying, or should I focus on reducing meat consumption? I can't seem to do everything at once."* These reflections align with Weick's (1995) notion of sensemaking, where uncertainty is not just cognitive but emotional - a space of confusion and potential insight. The disorientation students felt also resonates with Mezirow's (1991) concept of a disorienting dilemma, a necessary trigger for transformative learning.

Importantly, several reflections indicated a shift from frustration to curiosity. Students began to view complexity as a feature, not a flaw, of sustainability thinking*: "It's not about choosing the perfect path - it's about understanding the interconnections."* This shift reflects growing metacognitive awareness and systems literacy, essential for addressing sustainability as a 'wicked problem' (Rittel & Webber, 1973).

2.1 Awareness of Planetary Boundaries

Many students demonstrated a strong understanding of ecological limits, referencing climate change, biodiversity loss, and overconsumption. The planetary boundaries framework (Rockström et al., 2009) was often implicitly or explicitly invoked.

Students did not merely repeat environmental facts - they personalized them: *"I realized that the food I eat and the way I travel are part of a system that exceeds the Earth's capacity."*

Such ecological awareness illustrates growing anticipatory competence (Wiek et al., 2011), where learners connect present behaviors to long-term planetary consequences. However, several students also voiced skepticism toward superficial sustainability rhetoric: *"Greenwashing is everywhere. It's hard to know what's truly sustainable."*

This critical stance suggests emerging skills in normative assessment, a key dimension of sustainability literacy. A notable sub-theme was the awareness of geopolitical and social inequalities in environmental impact and responsibility. Some students reflected on the privilege of being able to "choose green" in Sweden, while others questioned the global North's historical and ongoing overuse of resources. These insights resonate with the concept of climate justice and demand that sustainability education integrate both ecological and social dimensions (Agyeman et al., 2003).

2.2 Ethical and Emotional Dimensions

Sustainability was described in profoundly ethical and emotional terms. Students reported feelings of guilt, anxiety, hope, and responsibility. For many, sustainability was not a policy issue - it was a moral imperative. *"I feel overwhelmed by the responsibility,"* one student wrote, "but I also feel a sense of duty."

These reflections validate Taylor's (2007) assertion that affective engagement is central to transformative learning. Emotions are not ancillary - they are part of the meaning-making process. Several students described emotional turning points: seeing environmental degradation firsthand, talking to relatives about intergenerational futures, or confronting their own complicity in unsustainable practices. Importantly, hope emerged as a counterbalance to guilt. Students viewed sustainability not only as burden but as opportunity for agency and connection. As one wrote: *"This course didn't just scare me—it gave me a language and community to think differently."* The emotional dimension of learning thus extends beyond personal catharsis to include collective resilience and ethical imagination (Nussbaum, 2001).

2.3 Everyday Sustainability Practices: Concrete Behaviors and Symbolic Actions

Many students grounded their understanding of sustainability in tangible, everyday behaviors. These included actions like reducing waste, using public transportation, choosing plant-based diets, and conserving energy at home. While these might seem modest at first glance, students described them as deeply symbolic—embodied statements of values, rather than isolated acts.

> *"I try to live what I believe in - even if it's small, like biking instead of driving. It signals to others what matters."*

This connection between personal practice and social influence aligns with Wenger's (1998) theory of communities of practice, where shared actions create and reinforce collective norms. Students didn't see these practices as private or apolitical; rather, they were viewed as micro-acts of leadership that ripple through social networks. Oxenswärdh (2017) emphasizes how everyday behaviors become foundational for collective learning—each action contributing to a larger cultural shift. Furthermore, these practices offered students a sense of agency in the face of global challenges. Amid systemic inertia and political delays, personal choice emerged as a space where students could align beliefs with actions, no matter how limited the impact.

> *"It's not perfect, but it's something. I feel more honest when I try to live sustainably."*

This theme reflects a key tension in sustainability discourse: the line between individual responsibility and systemic change. While students were aware of structural barriers, they resisted fatalism. Instead, they framed daily acts as both ethical commitments and pedagogical tools - ways to engage others and foster dialogue.

2.4 Leadership and Influence: Aspirations to Lead by Example and Mobilize Others

A recurring theme in the reflections was students' aspiration to lead - not through authority, but by modeling integrity and inspiring change. Leadership was described as personal, relational, and grounded in authenticity.

> *"I don't see myself as a CEO or politician. But I can lead by how I live - and how I talk to others about sustainability."*

This aligns with reflective and responsible leadership theories (Pless & Maak, 2011; Hargreaves & Fink, 2006), where leadership is a value-driven process focused on influence rather than hierarchy. Students expressed a desire to bridge the gap between ideals and action, not just for themselves, but as a catalyst for collective action. Some reflections invoked Senge's (1990) concept of shared vision, where leadership involves co-creating futures with others, rather than dictating them. This was especially visible in how students spoke about dialogue, inclusion, and empowerment as essential to sustainability leadership.

> *"Being a leader in sustainability means listening, not just talking. It's about helping others see that they matter in the solution."*

The desire to mobilize others extended beyond peers to include families, workplaces, and even digital communities. This reflects Freeman's (1984) stakeholder theory in action: students saw leadership as navigating interdependence, not imposing control.

2.5 Growth and Reflection: Identity Shifts and Transformation Through Reflective Learning

Reflection itself emerged as both a method and a theme. Students frequently described how the act of writing their reflections caused them to reevaluate assumptions, clarify values, and shift perspectives.

> *"Before this course, I saw sustainability as mostly about recycling. Now it feels like something that shapes who I want to be."*

This resonates with transformative learning theory (Mezirow, 1991; Taylor, 2007), where reflection facilitates deep identity change, especially when learners confront emotionally or ethically charged dilemmas.

Many students noted moments of discomfort, contradiction, or confusion - but framed these not as failures, but as necessary stages of growth. Reflection also served a connecting function - linking personal choices to systemic structures, and inner values to outer action. Oxenswärdh (2020a) emphasizes this in her work on reflective learning in entrepreneurial and organizational contexts, where reflection supports adaptation and value alignment.

> *"Writing made me realize that I don't have to have all the answers. But I need to stay aware and keep questioning."*

Some students described a lasting shift in self-concept - from sustainability as an external issue to a core part of their identity. This internalization suggests that reflection acts as a threshold - a point where learning becomes transformational, not just informational.

3. SYNTHESIS AND DISCUSSION

The themes identified in this analysis - ranging from complexity to emotional engagement to personal transformation - underscore the multi-dimensional nature of sustainability learning. Students' narratives are not isolated anecdotes; they are deeply reflective engagements with sustainability as both a cognitive framework and a lived experience. Together, these themes reinforce and extend existing theory while pointing to new directions for pedagogy and practice. Across the reflections, we see students engaging in systems thinking, not only in abstract terms but through their daily dilemmas and attempts to make sense of trade-offs. They begin to recognize the non-linearity and interdependence of socio-ecological systems - an essential competency in sustainability education (Wiek et al., 2011). Their struggles with uncertainty and contradiction mirror the broader challenges faced by societies attempting to transition toward sustainability.

Yet, what distinguishes these reflections is not only the development of analytical skills but also the integration of values, emotions, and identity. Students are not just learning about sustainability - they are exploring who they are in relation to it. This identity work is central to transformative learning (Mezirow, 1991) and reflects what Kegan (2000) calls the "subject-object shift" - a reconfiguration of self-awareness that allows individuals to take perspective on previously taken-for-granted assumptions. The emotional and ethical dimensions of the reflections point to the importance of emotional literacy in sustainability education. Rather than shielding students from feelings of grief, guilt, or frustration, educators can help them engage these emotions constructively. This approach aligns with recent work on eco-emotions and climate anxiety (Hickman et al., 2021), which suggests that emotional discomfort can catalyze deeper commitment when appropriately scaffolded. Students' emphasis on everyday practices also reveals the need to honor small-scale actions without romanticizing them.

Many students were self-critical and wary of the limitations of lifestyle politics. This self-awareness suggests a readiness to connect personal behavior with broader structural and cultural change. As such, sustainability education should balance the cultivation of personal agency with critical inquiry into political, economic, and institutional systems (Bengtsson & Östman, 2016).

Leadership was not imagined as command or control, but as a relational, value-based, and often quiet practice. Students described leadership in terms of presence, example, and humility - qualities that align with emerging models of adaptive and reflective leadership in sustainability transitions (Heifetz et al., 2009; Uhl-Bien et al., 2007). Importantly, several students pushed back against Eurocentric leadership ideals, calling for more culturally grounded, decolonial, and community-centered understandings. Finally, the act of reflection itself functioned as both method and outcome. Writing enabled students to slow down, make meaning, and locate themselves in the sustainability landscape. It bridged the personal and the political, the emotional and the analytical. This finding affirms the value of narrative pedagogy (Goodson et al., 2010) and reflective practices as central - not peripheral - to sustainability learning.

CONCLUSION

Taken together, the findings point toward a more holistic and human-centered approach to sustainability education. Pedagogical models should:

- Integrate structured reflection and narrative writing as ongoing practice, not one-off assignments.
- Create emotionally supportive spaces where difficult feelings can be acknowledged and processed.
- Link everyday actions to systems-level thinking, helping students connect personal behavior with policy and governance.
- Frame leadership as ethical presence and cultural responsiveness rather than managerial authority.
- Encourage identity exploration as a legitimate and essential part of sustainability learning.

In doing so, educators can move beyond transmissive models of education and foster what O'Sullivan (2003) called a pedagogy of transformation - an approach that honors complexity, cultivates imagination, and prepares learners to live and lead with integrity in an uncertain world.

This chapter has explored how students conceptualize sustainability through reflective writing, revealing that sustainability is not merely a technical or behavioral issue, but a deeply personal, emotional, and ethical concern. The thematic analysis of 120 reflections from students in a sustainability leadership course demonstrated how personal narratives serve as powerful vehicles for identity formation, moral reasoning, and systems thinking.

Students described sustainability as a space of tension - between ideals and constraints, emotion and action, self and society. Yet, through the act of reflection, they also discovered opportunities for transformation. They did not simply describe what sustainability is; they used writing to explore who they are in relation to it. This interplay between cognition, emotion, and identity suggests that sustainability education must address the inner landscape of the learner just as much as external knowledge and action frameworks.

The findings reaffirm that structured reflection can be a catalyst for transformative learning (Mezirow, 1991; Taylor, 2007), systems literacy (Sterling, 2001), and leadership development (Pless & Maak, 2011). Students who engaged in personal narrative construction often reported newfound clarity, agency, and ethical alignment. They moved from passive awareness to active authorship - defining sustainability not only as a global agenda but as a way of being.

Recommendations for Educators

To deepen the pedagogical impact of sustainability education, the following recommendations are proposed:

- Institutionalize reflective practices within sustainability curricula by embedding journaling, storytelling, and autoethnographic writing throughout programs.
- Facilitate emotionally safe learning environments, where students can process feelings such as guilt, grief, and hope without fear of judgment.

- Link reflection with action, encouraging students to connect internal learning with external engagement - through projects, community-based research, or participatory design.
- Acknowledge and support diverse epistemologies, cultural experiences, and leadership models, making space for decolonial, feminist, and indigenous perspectives on sustainability.
- Train educators to navigate affective dimensions of sustainability teaching and model vulnerability, ethical questioning, and reflective openness themselves.

Directions for Future Research

Building on this study, several avenues for further inquiry are suggested:

- Longitudinal research could examine whether reflective writing during education translates into sustained leadership and behavioral change in professional life.
- Cross-cultural studies might explore how narratives differ by national, disciplinary, or socio-economic context, enriching our understanding of sustainability identity.
- Experimental pedagogical interventions could test the comparative effects of different types of reflection (e.g., written, dialogic, visual) on learning outcomes.
- Finally, more attention is needed on how collective reflection - through dialogue, storytelling circles, or co-authored work - can enhance social learning and drive systemic change.

In closing, the chapter affirms that sustainability learning is not a linear acquisition of skills, but a recursive process of becoming. When students are given space to reflect critically and emotionally, they do more than absorb knowledge - they begin to rewrite the story of what sustainability can mean, for themselves and for the communities they serve.

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CHAPTER 2
OPEN ACCESS: THE FUTURE OF SCHOLARLY COMMUNICATION

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INTRODUCTION

The scholarly community has engaged in a long-standing debate about whether research should be openly accessible or kept behind paywalls. The debate centers on the crucial issues of accessibility, impact, and the overall benefit to the broader public and the scientific community. While proponents of both models claim that their approach has significant advantages, this chapter will explore the benefits of Open Access (OA), indicating why scholarly communication (SC) should be freely accessible to all. It also acknowledges the challenges of OA while at the same time offering insights on how to address those challenges through institutional repositories (IRs) and how technological innovations can sustain the solutions to those challenges, emphasizing that OA holds a viable and promising future for SC.

1. BACKGROUND

SC is "the system through which research and other scholarly writings are created, evaluated for quality, disseminated to the scholarly community, and preserved for future use" (Association of College and Research Libraries, 2003). The system includes both formal and informal means of communication. Peer-reviewed journals are examples of the formal means, while electronic mailing lists represent informal channels. Scholarly research is created as a public good to facilitate inquiry and knowledge. Historically, SC was led by the learned societies and their members worldwide, who published their research findings and scientific discoveries to share knowledge. Papers submitted to scholarly journals typically undergo a rigorous peer review process by subject experts, serving as a key quality control mechanism to maintain the journal's reputation. (UNESCO & Commonwealth Educational Media Centre for Asia, 2015).

From the 1970s, the formal system of SC started showing numerous signs of stress and crisis: the growing dominance of commercial publishers, market consolidation, sharp journal price increases outpacing library budgets, commercial interests-driven changes in copyright law that limit fair use and the public domain, the shift to electronic publishing with its significant challenges for long-term preservation of, and access to, information, all of which have led to reduced access to scholarship despite a rise in scholarly outputs.

It was against this backdrop of "the serials crisis" that the OA movement emerged, making scholarly journals freely available on the public internet for anyone to read and disrupting the profit margins of the publishing giants, which then grew beyond those of oil and technology companies and in line with the world's most profitable pharmaceutical company, Pfizer (Open Library of Humanities, n.d.).

OA, broadly defined as the free, immediate, and unrestricted availability of research outputs online (Open Access, n.d.), has gained traction as an alternative to traditional subscription-based academic publishing models (Suber, 2014). The movement began gaining momentum in the early 2000s with seminal declarations like the Budapest Open Access Initiative (BOAI) (Chan, 2002), which advocated for making scientific research freely available to all. This was followed by other key milestones, such as the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (Max Planck Society, 2003) and the Bethesda Statement on Open Access Publishing (Howard Hughes Medical Institute, 2003). Together, these initiatives laid the base for what has become a global movement towards democratizing access to knowledge.

At about the same time the OA movement emerged, IRs also started evolving from electronic preprint archives that allow researchers to share their work directly and instantly with peers, bypassing the delays of traditional publishing, into complex infrastructures that support the dissemination, preservation, and management of scholarly contents. With platforms like arXiv, launched in 1991 as an open-access repository for preprints in the fields of physics and mathematics, and PubMed Central, which provides free access to biomedical and life sciences research, IRs have proven indispensable in the OA movement (Ginsparg, 1997; Lu, 2011). They have reshaped global access to knowledge, particularly for under-resourced regions. Today, IRs are knowned as a core mechanism for delivering OA, especially via the green route, which is called Green Open Access.

The convergence of OA and IRs has revolutionized SC, bringing significant benefits to the academic community and the public.

OA allows researchers from underfunded institutions and developing regions to access the latest scientific findings (Rowlands, 2007), enhances the visibility of research, and increases citation rates (Piwowar et al., 2018). IRs play a crucial role in this ecosystem by acting as scientific communication platforms that make scholarly output discoverable, citable, and reusable. They utilize metadata standards, open-source technologies, and AI-driven search capabilities to ensure that users can easily find relevant resources.

Over the past two decades, the OA movement has established itself as a mechanism that removes subscription barriers, providing more equal access to knowledge, bringing a wider reach and higher citation rates to scholarly works, and making research more global and inclusive. As the movement has matured, two different models of OA publishing have emerged: Gold and Green OA, each with varying degrees of openness and financial implications for authors and institutions. Gold OA model, featuring fully OA journals, makes all content available without any access fees for readers but require authors to pay article processing charges (APCs), which shift the cost of publishing from the reader to the author or their institution (Schroter, 2006). Green OA model allows authors to self-archive in IRs, disciplinary repositories, or even personal websites all the articles they pulished in a non-OA journal, but only after a specified time post-publication (BMJ, n.d.). While Gold OA places financial burdens on authors, especially those working in disciplines that are under-funded, Green OA may limit immediate access to the most recent research (Gadd & Troll, 2019). The weaknesses of the two models have attracted debate over whether SC should be open or closed.

This chapter positions that SC should be open, by drawing on the positive impacts OA has had on SC. These impacts, which revolve around accessibility, visibility, and reproducibility, have been widely reported in SC- and OA-related literature. The next section will elaborate on these as giving reasons for why SC should be open.

2. IMPACT OF OPEN ACCESS ON SCHOLARLY COMMUNICATION

The OA movement has significantly altered the traditional academic publishing model, leading to several key changes in how research is disseminated and accessed. The most immediate impact of OA has been the expansion of access to research outputs. By making scholarly articles freely available, OA has empowered a broader audience to engage with academic knowledge, from researchers at underfunded institutions to independent scholars, policymakers, and the general public. This increased access has helped bridge the gap between the global North and South, allowing researchers in developing countries to participate more fully in the academic conversation. This section explores accessibility, visibility, and reproducibility as the major impacts OA has on SC, making it more inclusive, with knowledge from all parts of the world being incorporated into the global research conversation.

2.1 Accessibility and Democratization of Knowledge

One of the most profound impacts of OA has been its ability to democratize access to scholarly information. Traditionally, access to peer-reviewed research was restricted by paywalls, with subscriptions to academic journals often being prohibitively expensive, particularly for institutions and researchers in developing countries. This created an unequal system where only those affiliated with well-resourced institutions had regular access to the latest scientific findings.

OA seeks to rectify this imbalance by making research articles freely available to anyone with an internet connection. This accessibility has become especially important and particularly beneficial for researchers in low-resource institutions and developing countries (Chan et al., 2006). By removing financial barriers, OA allows these scholars to engage with cutting-edge research, fostering a more equitable academic environment. According to a report by Suber (2014), OA "levels the playing field," giving all researchers, regardless of their economic background, the opportunity to access high-quality research and contribute to the global body of knowledge.

In fields such as medicine, public health, and environmental science, where the timely dissemination of research can have life-saving implications, the accessibility afforded by OA is critical. For example, during the COVID-19 pandemic, many publishers temporarily removed paywalls on research articles related to the virus, illustrating how OA can play a vital role in global health crises (Alemneh et al., 2020; Else, 2020).This move significantly accelerated the sharing of crucial information, allowing for rapid advancements in understanding the virus and developing treatments and vaccines.

Furthermore, OA contributes to the democratization of knowledge by making it easier for non-academic audiences, such as policymakers and the general public, to access scientific findings (Suber, 2014). This wider accessibility supports evidence-based decision-making and helps bridge the gap between academia and society. In this way, OA promotes a more informed public and encourages the application of research beyond the confines of academia.

2.2. Visibility and Discoverability of Research

One of the key advantages of OA publishing is the enhanced visibility it offers to researchers, which in turn contributes to a highly diverse body of academic literature. Chan et al. (2006) acknowledged the critical role OA played in boosting the visibility of scholars and institutions from developing countries, or underrepresented or marginalized regions, where access to traditional publishing outlets may be limited. By removing the paywalls that previously limited access to research outputs from these regions, OA provides these researchers with greater opportunities to disseminate their work to a global audience, facilitating greater participation in global scholarly communication. This has led to a more diverse and inclusive academic publishing landscape, where knowledge from a wider range of perspectives is accessible and valued.

Empirical evidence supports the claim that OA articles are more frequently cited than their subscription-based counterparts (Archambault et al., 2014; Piwowar et al., 2018). As they are accessible to a global audience, OA articles are more likely to be read, shared, and cited by a wider range of scholars, practitioners, and policymakers.

Numerous studies have shown that OA articles tend to have higher citation rates and broader reach compared to paywalled contents. A study by Piwowar and colleagues (2018) found that OA articles receive 18% more citations on average than non-OA articles. This "OA citation advantage" has been observed across multiple disciplines, including science, technology, engineering, and mathematics (STEM) fields, as well as the humanities and social sciences (Colavizza et al., 2024; Norris et al., 2008). The increased visibility of OA articles not only boosts the individual impact of researchers but also accelerates the dissemination of knowledge within academic communities.

The broader reach of OA content is further amplified by the role of repositories, which ensure that OA articles are indexed and easily discoverable through search engines such as Google Scholar, PubMed, and CORE (Knoth & Zdrahal, 2012). These platforms aggregate OA content from institutional and subject-specific repositories, enhancing the discoverability of research for scholars worldwide. Additionally, OA content is more likely to be shared on social media, blogs, and academic networking sites, such as ResearchGate and Academia.edu, further expanding its reach and impact (Li et al., 2021; Tennant et al., 2020). The increased visibility provided by OA platforms and repositories further translates into higher citation rates, which can enhance the reputation and impact of researchers who publish in OA outlets.

2.3. Reproducibility and Research Transparency

OA plays a vital role in promoting reproducibility and transparency in scientific research by complementing other open science initiatives such as open data, open code, pre-registration, and open peer review (OPUS Project, n.d.). By removing paywalls and access restrictions, OA helps ensure that research outputs are widely available, enabling others to understand, evaluate, build upon the work, or independently replicate a study's results using the same data and methods. Reproducibility is a cornerstone of scientific integrity. The clear and open reporting of methods, data, and findings fosters trust and transparency within the scientific community and the public. Through its alignment with broader open science practices, OA strengthens efforts to make research more accountable, verifiable, and collaborative.

OA significantly supports research reproducibility by removing key barriers and fostering practices that enable independent verification of results. OA eliminates paywalls that often restrict access to original research articles, allowing scientists - regardless of institutional or geographic limitations - to engage with, test, challenge, and build upon prior studies. This is particularly crucial for researchers in low-resource settings, who may otherwise be excluded from participating fully in the global research ecosystem. In addition, OA journals frequently encourage or mandate adherence to established reporting guidelines such as CONSORT, PRISMA, and ARRIVE (EQUATOR Network, n.d.). These standards enhance transparency by promoting detailed reporting of research design, statistical methods, and data interpretation, all of which are critical for reproducibility. Moreover, OA often goes hand-in-hand with open data and code sharing (Wiley, n.d.). Articles are commonly linked to repositories like Zenodo, Dryad, or GitHub, providing access to the exact datasets and computational tools used in a study (HKUST Library, n.d.; Dryad, n.d.). This openness is especially vital in fields such as computational biology, machine learning, and meta-research, where direct replication or methodological adaptation is vital to scientific progress (Moreau & Wiebels, 2024; Outerbounds, 2024; Semmelrock et al., 2025).

OA plays a crucial role in promoting transparency throughout the research process by making scientific knowledge publicly available and aligning closely with open science practices. By removing subscription barriers, OA ensures that research articles are accessible to a broad audience - not just academics, but also journalists, policymakers, and the general public. This increased visibility encourages researchers to be more rigorous and honest in their reporting, knowing that their work is open to widespread scrutiny (Gargouri et al., 2010). Additionally, OA journals often require or strongly encourage authors to share raw data, code, and comprehensive methodologies, making it easier for others to verify results, conduct meta-analyses, or pursue related inquiries (PLOS, n.d.; Wiley, n.d.). Furthermore, many OA platforms, like F1000Research or eLife adopt open peer review models, where reviewer comments or critiques and author responses are published alongside the article (eLife, n.d.; Eisen et al., 2020; F1000, 2022).

This adds another layer of transparency to the editorial process and decisions, fostering accountability and allowing readers to see the scholarly dialogue that shaped the final publication. Through these mechanisms, OA not only democratizes access to knowledge but also strengthens the integrity and reliability of scientific communication.

While OA has brought significant benefits to SC, it is not without its challenges. Critics of OC who question whether models like "author-pays" (APCs) are sustainable or equitable, especially for underfunded researchers, have argued that SC should be paywalled or subscription-based. Others have raised other OA-related concerns including quality control, copyright, and long-term access. The next section will address these concerns and put forward possible solutions to sustaining OA.

3. CHALLENGES FACING OPEN ACCESS

The challenges facing OC include economic sustainability, issues related to quality control, the rise of predatory journals, legal and copyright concerns, and long-term access. Addressing these challenges is essential to ensure that OA can continue to thrive and provide equitable access to knowledge for all.

3.1. Economic Sustainability

A major challenge for OA is economic sustainability, particularly regarding who should bear the costs of OA publishing. Traditional publishing relies on subscription fees, but OA eliminates this revenue stream, necessitating alternative funding models. One common approach is APCs, where authors or institutions pay to publish in Gold OA journals. While this ensures free access for readers, it introduces financial barriers for scholars from underfunded institutions or developing countries. APCs can range from hundreds to thousands of dollars, limiting opportunities for participation in global scholarly conversations, especially for early-career researchers and those from less affluent regions.

Critics argue that APCs shift financial burdens onto authors, potentially reinforcing academic inequality (Björk & Solomon, 2014; Karlstrøm et al., 2024).

Although some publishers offer waivers or reduced fees for low-income countries, these provisions are inconsistently applied and insufficient to fully address the issue. However, beyond APCs, other funding models include institutional support, government grants, and non-profit consortia pooling resources to sustain the Gold OA infrastructure. In addition, IRs, which rely on institutional or public funding, can help ensure long-term sustainability for the economic models underpinning OA publishing through the Green route, which is Green OA. IRs are accessible to both authors and readers, without creating financial barriers (Mishra & Dora, 2010).

3.2. Predatory Journals and Quality Control

Another critical challenge within the OA movement is maintaining quality control, especially in light of the rise of predatory journals. Predatory publishers exploit the OA model by charging authors to publish their work without providing proper peer review or editorial oversight. These journals often have minimal editorial standards and can compromise the quality and integrity of SC by disseminating poorly vetted or even fraudulent research (Bocanegra-Valle, 2023; Bartholomew, 2014; Nettles & Theimer, 2016). More articles published in these illegitimate outlets can serious affect the viability of OA. Nevertheless, there are reputable sources such as Directory of Open Access Journals (DOAJ) and Open Access Scholarly Publishers Association (OASPA) which provide certifications for OA journals that meet recognized standards for transparency, peer review, and ethical publishing practices.

Moreover, quality control can be better achieved through Green OA, for which IRs have an integral role. Institutions' libraries or research offices, as gatekeepers of scholarly content, play a crucial role in combating the rise of predatory journals by employing strict vetting processes to curate articles from high-quality sources. This helps ensure that only legitimate and rigorously reviewed research is included in their repositories (Olivarez et al., 2018). In addition to quality control measures, educational efforts are needed to raise awareness among researchers about predatory journals. Institutions, funders, and libraries can help by providing resources and training on how to identify and avoid predatory publishers, ensuring that researchers can make informed decisions about where to publish (Elmore et al., 2020).

3.3. Legal and Copyright Issues

Another major challenge facing OA is navigating the complex landscape of legal and copyright issues (Esteve, 2024; McCormick, 2014; Murray, 2014). While OA makes scholarly content freely available to readers, questions remain about intellectual property rights and the licensing of OA materials. OA allows authors to retain copyright and granting broader permissions for the use and distribution of their work. Many OA journals use Creative Commons (CC) licenses, which offer a standardized way for authors to specify the terms under which their work can be shared and reused. These licenses range from the most permissive (CC BY), which allows for free redistribution and reuse with proper attribution, to more restrictive licenses that limit commercial use or derivative works. The flexibility of Creative Commons licenses enables authors to retain control over how their work is disseminated while promoting OA.

However, the use of CC and similar licenses can raise complex legal questions, particularly regarding international copyright laws, which vary widely between countries. For example, some countries may not recognize certain aspects of CC licenses, leading to confusion about the legal status of OA materials in different jurisdictions (Loren, 2006). Additionally, the growth of OA has led to concerns about plagiarism and misuse of openly accessible research, as there are fewer barriers to copying and redistributing content (Moorthy & Ramaiah, 2014).

Fortunately, with Green OA, starting with subscription-based journals or traditional publishing, copyright is often transfered from the author to the publisher, restricting how the work can be accessed and used. Then the IRs coming in as the OA phase for their works also play a crucial role in managing these legal aspects by ensuring that the works they host are properly licensed and by providing clear information about the rights and permissions associated with each article. They also work to protect the intellectual property of authors while promoting the free exchange of knowledge. For example, they often require authors to use specific licenses that ensure their work remains freely accessible but protected from unauthorized commercial exploitation (Harnad et al., 2004).

3.4. Preservation and Long-Term Access

Preserving scholarly content for the long term access is another significant challenge, particularly when it comes to OA materials. While the goal of OA is to make scholarly content freely accessible to current and future generations, digital preservation presents unique technical and financial hurdles.

As early in 2000, Waugh et al. (2000) pointed out that the preservation of digital content poses significant challenges, including the risks of data loss, file format obsolescence, and the degradation of digital storage media. Digital formats can become obsolete, and without proper preservation strategies, there is a risk that valuable OA content could be lost over time. Indeed, one of the major challenges in preserving OA content is the rapid evolution of technology. File formats, software, and hardware can become obsolete, making it difficult to ensure that digital content remains accessible over time (Laakso et al., 2020). Additionally, the sheer volume of OA content being generated presents significant storage and management challenges (Pernet et al., 2023). This requires ongoing financial and technical support, which ties back to the broader issue of economic sustainability (Burns et al. 2013).

To address this challenge, IRs employ a range of preservation strategies, such as LOCKSS (Lots of Copies Keep Stuff Safe) and CLOCKSS (Controlled Lots of Copies Keep Stuff Safe) systems, which ensure that multiple copies of digital materials are stored in geographically distributed locations to prevent data loss. These systems work by creating redundant copies of OA content, ensuring that even if one copy is lost due to technical failure or institutional closure, other copies remain accessible (LIS MCQs Practice, 2020). Additionally, IRs also address the challenge of maintaining interoperability and metadata standards to ensure that OA content remains discoverable and accessible over time. By adhering to common standards like Dublin Core or MARC, IRs can facilitate the exchange and preservation of OA content across different platforms and institutions (Walsh, 2014).

Moreover, IR solutions and capabilities have been being better improved by more technological innovations. This can further enhance the future of OA, or Green OA.

The next section will reveal the future directions of IRs, implying the future of Green OA, thereby further asserting that Green OA, through IRs, holds great future for SC.

4. TECHNOLOGICAL INNOVATIONS AND FUTURE DIRECTIONS

This section will explore how more technological developments are being integrated into IRs, and what future directions they may take to further support the OA movement. Key advancements such as linked data, artificial intelligence (AI), machine learning (ML), and the rise of open data repositories are expanding the scope of what IRs, today and in the future, can offer in fostering greater accessibility and engagement with scholarly content.

4.1. Linked Data and the Semantic Web

One of the most promising technological innovations influencing IRs is linked data and its role in the Semantic Web. Linked data refers to a method of publishing structured data so that it can be interlinked and become more useful through semantic queries (Peroni & Shotton, 2020). In the context of OA, linked data enables the connection of scholarly content across multiple platforms, repositories, and datasets, creating a web of interconnected information.

By employing linked data principles, IRs can significantly improve the discoverability and integration of OA content. For example, if a research article in one IRs is linked to datasets stored in another repository, users can easily navigate between related resources, enhancing their research experience. Metadata standards, such as Resource Description Framework (RDF) and SPARQL, facilitate these connections, allowing IRs to create rich, interconnected ecosystems of scholarly content (Färber et al., 2023).

An important aspect of linked data is its ability to enhance interoperability between repositories. Through shared metadata protocols, IRs can ensure that content housed in different systems can be accessed, searched, and integrated across platforms. This is particularly valuable for large-scale, international IR initiatives, such as BASE (Bielefeld Academic Search Engine), which aggregate contents from thousands of sources.

Linked data plays a central role in connecting disparate resources and making OA content more visible and accessible globally. The potential of linked data extends beyond discoverability. It can also facilitate new forms of knowledge representation, enabling richer and more nuanced ways of navigating and understanding research outputs. By linking diverse datasets and publications, researchers can explore complex relationships between different areas of knowledge, fostering new insights and interdisciplinary collaboration (Mohamed et al., 2024).

4.2. Artificial Intelligence and Machine Learning

The integration of artificial intelligence (AI) and machine learning (ML) technologies into IRs is transforming the way OA content is managed, discovered, and utilized. AI-driven systems are being employed in various aspects of IR operations, from content discovery and automatic classification to knowledge extraction from large OA datasets (Pham et al., 2023; Rivest et al., 2021).

One of the key areas where AI is making an impact is in content discovery, for example Google search. AI-powered search engines and recommendation systems are able to provide users with more relevant and personalized results by analyzing their search behavior and preferences. These systems utilize natural language processing (NLP) techniques, large language model, e.g., ChatGPT, to understand user queries and retrieve semantically related OA content, even when the exact keywords are not present. This represents a significant improvement over traditional keyword-based search, as AI can account for the context and meaning of a user's query, providing a richer search experience (Li & Lu, 2016; Chen et al., 2022).

AI and ML are also being used to automatically categorize and organize OA content. With the increasing volume of OA research, manual curation of IRs is becoming increasingly difficult. AI algorithms can automatically classify articles based on their contents, ensuring that they are properly indexed and easy to find or extract valuable insights from large-scale OA datasets (Pham et al., 2024; Sarma, 2018; Thayyib et al., 2023). For example, machine learning models can analyze the full text of a research article and assign it to one or more subject categories, improving the efficiency of IRs.

AI-based knowledge graphs are also being developed to represent and link OA content in new and meaningful ways (Bartholomew, 2014; Paulheim, 2017; Verma et al., 2023). By mapping relationships between concepts, authors, and datasets, knowledge graphs enable users to explore scholarly work through a network of connected ideas. These tools can enhance interdisciplinary research by identifying connections between fields that may not be immediately obvious.

CONCLUSION

This chapter highlights the roles of OA in reshaping SC. From the Budapest Open Access Initiative in 2002 to today's institutional and governmental policies, the historical evolution of the OA movement demonstrates a global commitment to equitable access to knowledge. OA has democratized research by eliminating paywalls, allowing scholars from underrepresented regions to both access and contribute to global scholarship. OA has also increased research visibility and transformed the academic publishing landscape into a better transparent system for research dissemination. With these significant impacts, OA should be poised to play an even more vital role in the continued democratization of global scholarly knowledge.

Although OA faces challenges such as economic sustainability, predatory journals, and legal issues around copyright and intellectual property, there are IRs serving as essential infrastructure to host, preserve, and disseminate scholarly contents through Green OA model, thereby addressing those challenges. The synergy of IRs and OA has transformed SC and academic publishing by democratizing the dissemination of research, fostering unprecedented global collaboration, and accelerating the pace at which new knowledge is created and applied.

The future of Green OA through IRs lies in technological advancements such as linked data, artificial intelligence, machine learning, and the semantic web, which promise to improve discoverability and integration of OA content across platforms. These innovations will enhance the ability of IRs to serve as OA stewards of scholarly content for future generations.

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CHAPTER 3
EVALUATION STUDIES IN EDUCATION: A NIGERIAN PERSPECTIVE

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INTRODUCTION

This chapter explores the foundational concepts, methodologies, and practical applications of evaluation studies within educational settings. It begins by defining evaluation in the context of education and distinguishing it from related concepts such as assessment and measurement. Various types of evaluation which are formative, summative, diagnostic, and ipsative are examined to highlight their specific purposes and uses. The chapter also presents key evaluation models, including Tyler's Objectives Model and the CIPP Model, which offer structured frameworks for conducting evaluations. Methodological approaches, both qualitative and quantitative, are discussed along with commonly used tools and techniques. It looked at the challenges in conducting evaluation studies in Nigeria. Finally, the chapter illustrates the emerging trends in educational evaluation in Nigeria.

1. WHAT IS EDUCATIONAL EVALUATION?

Evaluation is a crucial aspect of the educational process to judge the value of something by certain appraisal. Evaluation refers to a systematic process of collecting, analyzing and interpreting student's learning, performance, skills, or understanding, usually in relation to set objectives to determine the extent to which students are achieving instructional objectives (Chigeru, 2020). Evaluation is a comprehensive continuous process which is child-centred and a cooperative process that involves the students, teachers, parents and peer groups (Moudgil, 2025). It involves gathering data, evaluating the results, and applying the findings to make educated decisions to improve teaching and learning. The evaluation identifies strengths and weaknesses allowing educators to improve the educational experience and assure its continuing progress without copying the work of others.

Educational Evaluation is the systematic assessment of the design, implementation, and outcomes of an educational programme, policy, or intervention to determine its effectiveness, efficiency, relevance, and impact. Evaluation in education is closely related to, but distinct from, assessment and measurement. Measurement refers to the process of quantifying a learner's performance or characteristics through specific tools or instruments.

This is typically numerical, such as test scores, grades, or other metrics that reflect a learner's achievements. Assessment is the process of gathering information about student learning and performance. It involves the systematic collection of information about students' knowledge, skills, attitudes, or beliefs. Assessments are designed to evaluate not only the final product of a learner's work but also the process and skills involved. Contrarily, evaluation is a more comprehensive procedure that entails forming opinions regarding the worth, efficacy, or quality of a performance, program, or teaching, frequently based on the findings of measurement and assessment. These procedures work together to form the foundation for evidence-based educational planning and improvement.

2. IMPORTANCE OF EVALUATION IN EDUCATION

Evaluation provides valuable insight into the learning process, teaching effectiveness and outcomes. The importance of evaluation in education are:

Improving Teaching and Learning

Evaluation helps assess the extent to which students have achieved the learning objectives. By analyzing evaluation results, feedback on instructional strategies and student performance are gotten, educators can refine, improve and adjust teaching methods and curriculum to better meet learners' needs (Stiggins, 2023). Evaluation provides feedback to teachers and students. For students, evaluation offers insights into their progress and areas that need improvement. For teachers, it highlights areas where instructional adjustments might be needed. Formative evaluations, in particular, guide ongoing improvements during the learning process (Brookhart, 2022).

Accountability and Reporting

Accountability is the process used to ensure that educational institutions, teachers, and students meet established goals and standards. Schools and educators are often required to demonstrate accountability to stakeholders such as parents, policymakers, and funding bodies.

Summative evaluations assess whether educational goals have been met and provide evidence of effectiveness (Mertens, 2021). This accountability ensure transparency, improve quality, and promote trust in the education system.

Curriculum Development and Improvement

Evaluation data helps the teacher to identify the strengths and weaknesses of the curriculum which helps determine what aspects are effective and which need revision. It informs curriculum developers about the relevance and effectiveness of instructional materials and course designs. This feedback from formative and summative evaluations ensures that curricula remain current and aligned with educational standards and learning objectives (Guskey, 2023).

Decision-Making and Policy Formation

Educational evaluation supports policy decisions regarding student placement, program continuation and educational reforms. It also helps educators to take decisions about success in specific future activities and provides guidance to further studies and occupation (Ehiemere, 2022). Evidence-based decisions depend on reliable evaluation results to enhance system-wide effectiveness (Patton, 2022).

Student Motivation and Self-Assessment

Evaluation encourages student self-reflection and motivation by identifying strengths and areas for improvement. Self-assessment improved students' learning motivation that influenced students' understandings towards the learning materials taught. When students understand evaluation criteria, they become active participants in their learning journey (Black & Wiliam, 2023).

3. TYPES OF EDUCATIONAL EVALUATION

Educational evaluation encompasses various types, each serving distinct purposes in assessing educational processes, outcomes, and programs.

Understanding these types helps educators choose the appropriate evaluation method based on their goals.

3.1 Formative Evaluation

Formative evaluation is a process employed during instruction to track students' development and learning, offer feedback, and modify teaching and learning tactics in order to enhance students' comprehension prior to final or terminal exams. Its objectives are to monitor a student's learning progress during instruction, detect learning challenges and gaps early, encourage ongoing development, and assist educators and learners in implementing adjustments that will improve learning (Hatkar, 2025). It focuses on identifying strengths and weaknesses while instruction is still in progress (Brookhart, 2022). This type of evaluation supports adaptive teaching strategies and promotes student engagement.

3.2 Summative Evaluation

Summative evaluation refers to the process of evaluating students' knowledge, abilities, or accomplishments at the conclusion of a class time. It occurs at the end of a unit, term or an instructional period, measuring student achievement or program effectiveness against established standards (UNESCO, 2019 & Stiggins, 2023). It is primarily used for assigning grades, certifying competence, or making decisions about program continuation. summative evaluation is used to make final judgments about student performance or the effectiveness of a program or curriculum.

3.3 Diagnostic Evaluation

Diagnostic evaluation aims to identify learners' prior knowledge, skills, strengths, weaknesses, misconceptions, and learning needs before instruction begins. This evaluation helps tailor teaching to individual or group needs (Guskey, 2023). Its primary objective is to pinpoint the precise areas in which pupils may falter so that educators can modify their lessons, offer remedial assistance, and avert further learning challenges. It offers a starting point for lesson preparation and tailoring instructional techniques. It is particularly useful in remedial education and personalized learning plans.

Therefore, determining what students know, before teaching a topic, can according to Assessing understanding (n.d., para. 3) help improve teaching in two ways:

- Effectiveness: Understanding students' prior knowledge allows you to begin teaching students at an appropriate starting point as well as providing instruction and scaffolding within students' Zone of Proximal Development.
- Misconceptions: If students have misconceptions about a topic, these will prevent students from building correct understandings of new content. Therefore, it is best to determine common misconceptions and their prevalence before teaching a topic, ensuring that incorrect prior knowledge is addressed.

3.4 Ipsative Evaluation

In the field of education, ipsative evaluation refers to comparing an individual's performance on a measure to his or her past performances. It involves comparing a learner's current performance with their previous performance rather than with others' achievements. This type encourages personal growth and self-improvement (Black & Wiliam, 2023). Ipsative evaluations give teachers important information about each student's path. Teachers can effectively adapt their instruction to fit the varied requirements of their pupils if they have a better understanding of each student's unique strengths, limitations, and preferred methods of learning. Because they feel heard, seen, and supported on their learning journeys, students' academic performance and engagement can be greatly improved by this individualised approach. This dynamic process ensures that students are continually challenged, motivated, and engaged, preventing stagnation and promoting a culture of continuous improvement. According to Campbell (2023) the benefits of ipsative evaluation to the students and teachers are:

For the students:

1. Gives students the ability to own and feel in charge of their education and personal growth.
2. Gives students a reason to be proud of their achievements

3. Instead of punishing failure to meet a communal standard, it provides continuous internal drive for development.
4. Prioritises the pace of improvement over certain competency metrics; a student may be a faster learner if they make more progress yet have a lower normative assessment score.
5. When a student is tested more than once using the same exam material, their retention is improved.
6. Many students are familiar with the idea and find the procedure enjoyable since it uses progress tracking as a motivating tool, drawing inspiration from fields like nutrition, health, and athletics.

For the Teacher:

1. Allows teachers to monitor their success with various student groups, including those with similar skills and others who might excel in different subjects.
2. Aids in determining which students are most eager to study and are on an upward track.
3. Enables teachers to improve their ability to maximise learning results for all students, not just the most talented ones.
4. Allows for focused and thorough feedback based on areas that have improved the most and the least over time.

3.5 Norm-Referenced Evaluation

Norm-referenced evaluation compares a student's performance to that of a peer group, usually a representative sample called the norm group. By ranking students according to their results, these examinations help teachers see how each student's performance stacks up against that of other test takers. ranks students relative to a peer group. It is viewed as a ranking system that helps teachers, parents, and administrators see where a student stands academically (Zhaoning, 2024). It is used to determine relative standing, such as percentile ranks, and often guides competitive decisions like admissions (Mertens, 2021). Norm referenced evaluation help teachers identify top and low performers within a group, making it useful for competitive settings like college admissions and scholarships.

It provides a clear ranking by comparing a student's performance to a larger population and highlights exceptional talents and outliers that might otherwise be overlooked. The principles of norm referenced evaluation are:

Comparison to a Norm Group

Instead of being assessed against predetermined criteria, students are evaluated in reference to a representative group (norm group). This guarantees that a student's performance accurately represents their relative standing among peers (Popham, 2000; Kubiszyn & Borich, 2016).

Ranking and Comparative Status

Ranking students to demonstrate their performance in relation to others is the main goal. Percentiles, stanines, or standard scores are used to interpret the results (Zhaoning, 2024).

Standardised Testing Conditions

To guarantee fairness, norm-referenced evaluation are given in a controlled, consistent environment. The valid comparisons between test takers are made possible by uniform administration (Kubiszyn & Borich, 2016).

3.6 Criterion-Referenced Evaluation

Criterion-referenced evaluation measures each student's performance against predetermined standards or criteria (Popham, 2000). It measures student performance against predefined learning objectives or criteria, rather than against other students (Kubiszyn & Borich, 2016). Their grade reflects how well they've mastered these specific skills, not how they compare to their classmates (Oosterhof, 2009). This approach assumes that with proper instruction and sufficient time, most students can achieve the established learning standards (Stiggins, 2005). It focuses on absolute achievement rather than relative performance. It emphasizes mastery of content and skills (Patton, 2022).

3.7 Programme Evaluation

Programme evaluation is a systematic process of determining the merit, worth, and significance of a program by carefully examining its planning, implementation, and outcomes. It offers an organised method for determining whether a program is accomplishing its objectives, pinpointing areas in need of development, and choosing future course for the program. Program evaluation evaluates the overall impact, efficacy, and efficiency of educational initiatives. It informs decision-making regarding program continuation, modification, or termination (Patton, 2022). Patton (2008) defines program evaluation as "the systematic collection of information about the activities, characteristics, and outcomes of programs to make judgments about the program, improve program effectiveness, and inform decisions about future programming." Evaluation aids in determining how curriculum, instructional strategies, and educational policies affect student results in educational contexts. According to Fitzpatrick, Sanders, and Worthen (2011), it enables educators and policymakers to make data-driven decisions, pinpoint areas that require improvement, and put evidence-based practices into action that improve learning experiences. Program evaluation often includes both qualitative and quantitative data.

4. EVALUATION MODELS IN EDUCATION

Evaluation in education is a systematic process for determining the merits, worth, and value of things, such as teaching strategies, student performance, and instructional programmes. Frameworks for planning, carrying out, and evaluating educational activities and results are provided by evaluation models. These models support stakeholders, educators, and legislators in making evidence-based decisions. This paper explores the most commonly used evaluation models in education, which are CIPP.

4.1 CIPP Model (Context, Input, Process, Product)

The CIPP model, which stands for Context, Input, Process, and Product, is a comprehensive framework designed for evaluating educational programs and interventions. It was developed by Daniel Stufflebeam (1960s) to support decision-making and continuous improvement throughout a programme’s lifecycle. It addresses planning, implementation, and outcomes.

According to Zhang et al. (2011), the CIPP model is particularly valuable in educational settings where policymakers, administrators, and teachers require systematic methods for evaluating curriculum effectiveness, school programmes, teacher training, and instructional strategies. In Nigeria, where educational reforms are frequent and resources often constrained, the CIPP model offers a structured way to evaluate programs like the Universal Basic Education (UBE) scheme, National teacher development programs and Curriculum reforms introduced by the Nigerian Educational Research and Development Council (NERDC).

Content

In order to assist decision makers in defining objectives and priorities and in evaluating goals, priorities, and outcomes, context evaluations look at needs, issues, resources, and opportunities. Context evaluation helps educators tailor their programmes to meet the specific needs and expectations of learners and stakeholders. It involves examining the social, cultural, economic, and political factors that may influence the effectiveness of the program.

Input

Input evaluation is the second part of the CIPP model. The methods, plans, and resources required to accomplish the program's objectives are evaluated through input evaluation. Input evaluations assess alternative approaches, competing action plans, staffing plans, and budgets for their feasibility and potential cost effectiveness to meet targeted needs and achieve goals (Fitri, Sukiman, & Nurusshoimah, 2024; Temiz & Başal, 2023). Input evaluation centers on the planning and design phase of the curriculum. It involves assessing the resources, materials, personnel, and strategies used in programme development. Decision makers use input evaluations to assist others in evaluating an effort's plans and budget, as well as when selecting among competing plans, creating financing submissions, allocating resources, assigning staff, and scheduling work (Hardiyanti, Shofwan, & Gupta, 2025). It includes evaluating the program's design, curriculum, staffing, funding, and the availability of equipment or infrastructure needed for the program (Nugraha, Syihabuddin, Mulyati, & Damayanti, 2024; Indrianto & Nurdin, 2024).

Process

Process evaluation monitors the program's delivery and determines whether it is being carried out according to plan. This entails keeping an eye on daily operations, ensuring resources are being spent efficiently, and confirming that the program is being run on time (Evans, Bettinger, & Antonio, 2025; Fitri, Sukiman, & Nurusshoimah, 2024). Process evaluation examines the procedures used for implementation, including instructional methodologies, student involvement, and any unanticipated difficulties that may come up while the program is being carried out (Frontiers in Education, 2022; SEED cluster RCT, 2024).

Product

The final stage in the CIPP model is Product Evaluation. This phase assesses the outcomes of the program, evaluating whether the goals set in the context evaluation phase have been achieved. Product assessment uses learning outcomes, skills learnt, or any other predefined success indicators to gauge the program's effectiveness. Both immediate and long term effects are taken into account at this point (Temiz & Başal, 2023; Nugraha, Syihabuddin, Mulyati, & Damayanti, 2024). Determining if the program achieved its goals and had the intended impact on the community or pupils is the aim (Fitri, Sukiman, & Nurusshoimah, 2024; Li, 2025). Product evaluation aids in determining the causes of program failures and offers suggestions for future development (Li, 2025; Temiz & Başal, 2023).

4.2 Tyler's Evaluation Model

Tyler's Model, developed by Ralph Tyler in the 1940s, is one of the most foundational models in theory. It focuses on aligning educational objectives with instructional strategies and assessments. The model is rooted in the idea that clear, well-defined objectives are the key to successful learning. Tyler's Model, is an objective-based approach to evaluation. It focuses on setting clear goals, selecting appropriate learning experiences, organizing them logically, and assessing whether the goals have been achieved.

The simplicity of this model makes it a practical tool for educators, especially when working with standardised courses with clearly defined outcomes. The four key questions of Tyler's Model are:

- What educational objectives should the programme seek to attain? It asks what the learners should know, do, or value after the instruction.
- What educational experiences can be provided that are likely to attain these objectives? It asks what specific learning experiences (activities, materials, assignments) will be used to help students achieve the stated objectives.
- How can these educational experiences be effectively organized? It addresses the principles for sequencing and integrating the content and learning experiences to ensure maximum cumulative effect on the learner.
- How can we determine whether these purposes are being attained? It asks how the effectiveness of the programme will be assessed and measured to determine if the objectives were actually met.

4.3 Scriven's Goal-Free Evaluation Model

Scriven's Goal-Free Evaluation (GFE) is an evaluation model that purposefully evaluates a program or product without being aware of its declared aims or objectives beforehand. It was created in the 1970s by philosopher and assessor Michael Scriven with the primary objective of avoiding "goal blinkers" and promoting the identification of a program's actual impacts, especially the unexpected ones. The evaluator focuses on actual outcomes rather than stated goals, reducing bias and uncovering unintended effects. In the Goal-Free Evaluation model, the evaluator begins by receiving comprehensive documentation that details the program's activities, structure, and context, but is crucially shielded from the list of its stated objectives. This intentional blindness prevents the evaluator from being biased by the program's aspirations. The evaluator then proceeds directly to the data collection phase, systematically gathering evidence of all observed effects, outcomes, or changes in the target population.

This inquiry is broad and deep, encompassing results such as changes in test scores, observable behavioral changes, wider community impact, and modifications in resource allocation, ensuring that both expected and unexpected results are identified.

5. EDUCATIONAL EVALUATION AGENCIES IN NIGERIA

They are bodies established and authorised by law to assess and evaluate students' scholastic achievements. They also monitor and evaluate educational institutions and systems. They contribute innovations and progress to the Nigerian educational sector. Some are examination bodies set up to administer tests and grant certificates for various educational levels (Nkwocha (2019). These consist of the National Business and Technical Examinations Board (NABTEB), the National Examinations Council (NECO), the West African Examination Council (WAEC), the State Education Development Centres (S.E.D.C.), and the National Teachers' Institute (NTI). They offer certificates for various educational levels and administer tests (summative evaluation). Some evaluation agencies are established to conduct tests used for admission of students at different levels of education. Such a test is intended to assess the entry behaviour of learners in particular courses or programmes. An example of such an agency is the Joint Admission and Matriculation Board (JAMB). There are also agencies established mainly for evaluation of the effectiveness of specific institutions in achieving the aim for which they were established. These include the National Universities Commission (NUC), the National Board for Technical Education (NBTE), and the National Commission for Colleges of Education (NCCE). They give approval for the running of all academic programmes in Nigerian tertiary institutions. They ensure orderly development of a well-coordinated and productive systems that will guarantee quality and relevant education for national development.

6. METHODS AND TOOLS FOR CONDUCTING EDUCATIONAL EVALUATION IN NIGERIA

Here are the most commonly used methods in Nigerian educational evaluation:

6.1 Quantitative Methods

In quantitative approaches, educational inputs, processes, outputs, and outcomes are assessed through the gathering and analysis of numerical data. In order to evaluate teacher effectiveness, school quality, policy outcomes, and student performance, these techniques are frequently employed in Nigeria.

Standardized Achievement Tests

Standardized achievement tests are assessments designed to measure students' academic performance in specific subjects, providing a uniform way to evaluate educational outcomes across different populations (Smith & Johnson, 2021). These tests often adhere to strict procedures for administration and scoring, ensuring comparability of results (Anderson et al., 2022). They play a crucial role in evaluating the effectiveness of educational policies and programs, particularly for special education and gifted students, as they help identify learning gaps and inform instructional strategies (U.S. Department of Education, 2023).

Questionnaires/Surveys

A questionnaire is a list of structured or semi-structured questions or items used as data collection tool to gather information from individuals about their opinions, behaviors, experiences, or characteristics (Bhandari, 2023). It is commonly used in research, surveys, evaluations, and assessments, especially in fields like education (Creswell & Creswell, 2018). A survey is a research method where you collect and analyze data from a group of people. A questionnaire is a specific tool or instrument for collecting the data. Using questionnaires, especially via telephone and mail routes, makes it possible to reach a huge number of people at a comparatively low cost (Dillman, Smyth, & Christian, 2014).

With postal and telephone surveys, it is possible to reach people who are spread out over large geographic areas or who live in remote areas. Online surveys make it simple to distribute and reach a younger audience (Evans & Mathur, 2005). Along with the convenience of scheduling phone callbacks, respondents often appreciate the freedom to do postal questionnaires at their own pace.

Rating Scales and Likert Scales

In surveys and questionnaires, rating scales are often used instruments that let participants indicate how much they agree, feel, or perceive a particular topic. By asking participants to rate a statement or issue on a continuum, they offer a means of quantifying subjective beliefs or attitudes. Rating scales come in a variety of formats, including verbal (bad to excellent), graphic (sliders), and numerical (1 to 5).

A specific and widely used type of rating scale is the Likert scale, which measures respondents' attitudes or feelings toward a statement by offering a balanced range of response options. Typically, a Likert scale gives a statement followed by a number of response categories, usually five or seven, that range from strong agreement to strong disagreement (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree). Because of its simplicity, ease of analysis, and capacity to measure the intensity of sentiments, the Likert scale is highly regarded. In educational research, it is frequently employed to evaluate beliefs, attitudes, and actions.

6.1.1 Quantitative Data Analysis Tools

In educational research and evaluations, quantitative data analysis techniques are crucial because they allow researchers and educators to examine numerical data, spot trends, and reach well-informed conclusions. Several platforms and technologies are being used for this in Nigeria. The widely used are:

SPSS (Statistical Package for the Social Sciences)

SPSS is a complete statistical analysis and data management program. frequently employed in descriptive statistics, regression analysis, and hypothesis testing. extensively used at research institutes and universities in Nigeria.

STATA

Stata is a software package for statistical analysis of data. It is a popular statistical software program for data administration, statistical analysis, and graphical visualization. Because it can handle enormous datasets and execute complex statistical models, it is popular among researchers, economists, social scientists, and educators. It is a powerful tool for data manipulation and statistical analysis. It is preferred and utilized in various academic and research settings in Nigeria (Ugboma et al., 2022). Strong data management features provided by STATA make it simple for users to import, clean, and arrange data effectively. Descriptive statistics, regression models, hypothesis testing, survival analysis, time series, and many other sophisticated methods are among the many statistical studies it offers. Furthermore, STATA makes it possible to produce excellent charts and graphs, which aid users in efficiently and simply visualising their data. Its programming capabilities increase workflow efficiency by automating repetitive processes using an integrated scripting language. Additionally, STATA encourages reproducibility by keeping an accurate record of every step involved in data processing and analysis, which is crucial for guaranteeing openness and reliability in research.

Microsoft Excel

Microsoft Excel is a versatile spreadsheet software developed by Microsoft, used globally for organizing data and performing financial analysis. Its key features include data entry, management, financial modeling, and charting. Excel is extensively used in finance and accounting for budgeting, forecasting, and analysis due to its robustness and flexibility. It supports various functions, formulas, and shortcuts to enhance productivity and efficiency.

Excel is a vital tool for professionals in finance, accounting, and other fields requiring data organization and analysis (Microsoft, 2023). Accessible and commonly used in schools and universities across Nigeria.

R and Python

R is a free, open-source software environment and programming language that is mostly used for graphics and statistical computing. Its extensive suite of packages that facilitate data processing, statistical modelling, and visualisation makes it a top choice for statisticians, data scientists, and academics. R's syntax was created especially for data analysis, which makes it effective for applications like machine learning, regression, and hypothesis testing. Because of the constant development of new packages by its community, it is incredibly flexible for analysing educational data and doing quantitative research.

Python is a popular general-purpose programming language that is renowned for being easy to learn and understand. Thanks to robust libraries like scikit-learn (machine learning), Matplotlib and Seaborn (data visualization), NumPy (numerical computing), and Pandas (data manipulation), it has emerged as one of the top tools for data science and analytics. Python is widely used in educational and research settings for creating unique data analytics workflows and models because of its adaptability, which goes beyond data analysis to include web development, automation, and more (Van Rossum & Drake, 2013; VanderPlas, 2016). It is gaining popularity among researchers and data scientists in Nigeria.

Since R and Python are both free and open-source, students, teachers, and academic institutions can use them with great ease. Through interactive notebooks and scripting, they facilitate reproducible research by enabling researchers to clearly record and communicate their analysis procedures. These languages can efficiently handle big datasets and carry out intricate statistical or machine learning analyses. Furthermore, both have sizable and vibrant user bases that provide copious amounts of tutorials, documentation, and open-source packages, which facilitate learning and efficient use for both novices and experts.

6.2 Qualitative Methods

Qualitative methods are thoroughly used to examine experiences, perceptions, and surroundings, to collect descriptive and non-numerical data. Among the methods include document analysis, case studies, focus groups, and interviews (Patton, 2022). These techniques offer deep insights into how and why educational initiatives are successful or unsuccessful. Qualitative methods are particularly well-suited when the project or programme you are evaluating is new or includes a lot of local variation, or where there are small numbers involved. For example, qualitative data can offer richer descriptions of how a programme is implemented differently in different contexts (Patton, 2015). Qualitative methods are also good for understanding complex issues, including how people feel about something. In quantitative data collection, emotional responses are often reduced to simple characteristics such as satisfaction scales. These can miss the depth of response to an issue which qualitative methods can help to uncover (Creswell & Poth, 2018). The most common qualitative evaluation tools are:

Interview (Structured, Semi-structured, Unstructured)

An interview is a qualitative data gathering technique in which a researcher or assessor directly interviews a person or group to get in-depth details, viewpoints, experiences, or emotions regarding a specific subject. Interviews can be classified as semi-structured (allowing for some flexibility but with some prepared questions), unstructured (more akin to a guided conversation without fixed questions), or structured (with fixed questions) (Kvale & Brinkmann, 2009). During interviews, you have more time and chance to delve deeper into the participants' experiences. You may gain a better understanding of the context and procedures your program uses, as well as the perspectives, experiences, and emotional reactions of those participating, if your participant is informed about the subject. Employing less structured interviews also enables people to guide you to conclusions that, until the participant explains them, you were unaware were significant or pertinent (Patton, 2015).

Focus Group Discussions (FGDs)

In focus groups, a small group of people with relevant insight are invited to discuss an issue together with a facilitator. The facilitator will guide the topics under discussion, but good focus groups encourage participants to respond to each other. This method fosters interaction and dialogue, which can generate diverse viewpoints and provide a deeper understanding of community dynamics (Krueger & Casey, 2015; Morgan, 1997). Practically speaking, since a single focus group may consist of 6–8 participants, focus groups can be an affordable method of collecting qualitative data from a larger number of participants. Even while online focus groups are becoming more and more popular, it may be more difficult to reach a large number of participants if they are geographically dispersed

Classroom Observations

In educational settings, observation entails methodically observing and documenting actions or occurrences. It is useful for evaluating classroom dynamics and instructional strategies and can be either structured (using checklists) or unstructured (using narrative notes) (Brookhart, 2022). Observations enable the gathering of data in an unaltered environment by seeing a program activity being delivered. While watching, the researcher may pretend to be a participant in the action or observe from outside.

Document Analysis (e.g. curriculum materials, policy documents)

In certain situations, or activities, documents are already being created, which the researcher may be able to examine. They could be documents prepared to support, encourage, or direct the action, or they could be the result of involvement in the activity. Documentation changes could also result from the program under review. For instance, lesson plans, career materials, or other instructional materials produced by participating teachers may be useful information to gauge the impact of a program.

6.2.1 Qualitative Data Analysis Tools

Qualitative data analysis (QDA) tools help researchers organize, code, analyze, and interpret non-numerical data such as interview transcripts, open-ended survey responses, field notes, videos, and more.

NVivo

Effective with qualitative and mixed-methods research, NVivo helps you organize, store, analyze and draw insights from data sources, such as literature, interviews, social media platforms, web content and open-ended questions. It facilitates deeper analysis and allows you to import various file types, such as: Videos, Images, Surveys, Emails and Spreadsheets.

ATLAS.ti

Another well-known tool for analysing qualitative data is ATLAS.ti, which is renowned for its adaptability and strong analytical powers. Text, photos, audio, video, and even geographic data are among the many data forms it handles. Its visual approach—which allows users to identify linkages between codes, themes, and concepts—is one of its main advantages. This is particularly helpful when conducting grounded theory or theory-building research. Additionally, ATLAS.ti offers teamwork features that enable several researchers to collaborate on a single topic. With versions for Windows, Mac, and the web, its user interface is sleek and contemporary, providing cross-platform capability for increased accessibility.

6.3. Mixed Methods

Combines both quantitative and qualitative methods. It is increasingly used in Nigeria to give a comprehensive view.

7. CHALLENGES IN CONDUCTING EVALUATION STUDIES IN NIGERIA

In light of the achievement of specified learning objectives, evaluations should yield useful data on students and the efficacy of instruction. Nonetheless, Ohirii and Oscar, (2023) viewed that Nigerian educational evaluation has numerous difficulties, among them are:

- The reviewers' unfamiliarity with the program under review
- Insufficient professional expertise. Instructors without the requisite experience might not carry out the activity (assessment) correctly.
- One element influencing the efficient evaluation of educational programs in Nigeria is the lack of qualified assessing personnel in the Federal, State, and Local Government Area ministries of education.
- The evaluation's investigators have narrowly targeted investigating abilities.
- Incapacity to write and interpret evaluation results so that laypeople can comprehend them
- The major issue with evaluation is the employment of antiquated, manual, and out-of-date methodologies and tactics.
- Failure of the authorities to provide finances for the implementation of educational assessment and a lack of commitment to collaborating with project partners to determine joint impacts
- The scheme's requirements for recording the results may be hampered by a lack of storage space and essential examination supplies.
- Failure to pay instructors their salary and benefits on time. A teacher who receives low pay and frequently misses payments could lack the motivation to perform their duties.
- Inadequate evaluation equipment, such as computers, projectors, writing materials, etc., are a challenge for officers working in the many government departments and organisations.
- Insufficient knowledge of the subject being evaluated and evaluation procedures
- In order to get accredited, many postsecondary institutions do pretend to meet acceptable requirements during the accreditation process. Assessors who are meant to accurately complete the accreditation process frequently collaborate with these institutions.
- One major obstacle to conducting an efficient assessment of Nigeria's educational institutions is the country's insecurity.

- In Ogunode, Adah, Wama, and Audu (2020), the UN agency's UNESCO Global Education Monitoring Report (GEM) stated that 19,000 teachers have been relocated in Northeastern Nigeria, impacting educational access. The outbreak has also claimed the lives of numerous educators.

8. EMERGING TRENDS IN EDUCATIONAL EVALUATION IN NIGERIA

Traditional summative evaluation techniques have been replaced in recent years by more dynamic, technology-enhanced, data-driven, and holistic evaluation approaches in Nigerian education. One of the main emerging trends is the growing use of artificial intelligence (AI) and related technologies to assist with performance prediction, feedback, and assessment. Research indicates that student performance prediction tools, multimedia e-learning platforms, and adaptive learning systems are becoming increasingly popular in Nigeria. However, more sophisticated tools, such as intelligent tutoring systems, are still less common due to challenges such as limited funding, technical expertise, and inadequate infrastructure (Bali et al., 2024).

Predicting student outcomes, tracking progress, identifying at-risk students, and influencing institutional decision-making, the use of Learning Analytics (LA) and Big Data in Nigerian tertiary institutions is a new trend that aims to improve assessment and evaluation. However, research indicates that a number of major obstacles, such as a lack of institutional capacity and problems with data quality, severely impede practical implementation. Many higher education institutions in Nigeria lack the technical know-how and human knowledge (talent) needed to effectively gather, clean, analyse, and visualise massive information.

The usage of specialised Big Data Management Systems (BDMS) and tools necessary for efficient analytics may be unknown to or untrained in lecturers and administrators (Oguine et al., 2022; Osuji & Chukwudi, 2023). There are difficulties in guaranteeing the accuracy and validity (reliability) of the data gathered from diverse sources (Wang & Weibe, 2014, quoted in Adetunji, Adeyemo & Adebisi, 2024).

There are difficulties in data capturing, integration, and standardization across different institutional departments, which is essential for comprehensive analytics (Oladipo, Oyeniran & Oyelade, 2020). The problem extends to infrastructural deficiencies (e.g., inadequate Information and Communication Technology (ICT) infrastructure and tools) and the significant cost implications of acquiring, storing, and managing Big Data technology. Another significant challenge is the low awareness among educators, policymakers, and administrators regarding the sources, potential uses, and advantages of assessment Big Data, which limits the drive for effective implementation (Anikweze, Ugodulunwa, & Mainoma, 2019).

Another trend is the movement away from high-stakes or end-of-course exams and towards ongoing evaluation. In order to promote more formative evaluation techniques, decrease examination misconduct, and give frequent feedback, continuous assessment, or CA, is being promoted. There are still issues with standardisation, teacher preparation, and making sure that CA is used to inform instruction rather than only be used for grading.With the growing usage of e-learning platforms, virtual classrooms, online tests, and ICT tool integration, the digital transformation of evaluation is also gaining prominence. These enable quicker, more flexible, and remote examination. Schools and universities increased their use of digital technologies for assessment and evaluation, particularly during and after disturbances like the COVID-19 epidemic. Although there is potential, there are still important challenges to solve, such as the digital divide (access to devices and the internet), the validity of online tests, and academic integrity in digital environments (Verhoef & Coetser, 2021).

A major concern in contemporary education is the growing emphasis on evaluation validity and alignment, which highlights the need for assessment instruments to accurately gauge students' mastery of key curriculum skills and intended learning outcomes (LOs) (Martone & Sireci, 2009; Webb, 2002). Since these sophisticated competences are essential for success in the modern workforce, a significant component of this reform is the need to go beyond simple rote memory testing in order to effectively assess higher-order thinking skills (HOTS), such as digital literacy, problem solving, and critical thinking (Liu et al., 2016).

There is increasing interest in changing assessment construction and implementing more dynamic approaches in order to accomplish this alignment and evaluate HOTS, which often requires students to analyze, evaluate, and synthesize information (Anderson et al., 2001). This includes a move towards participatory evaluation, which promotes greater ownership of the learning process by involving teachers and students in the assessment's design (Benson et al., 2009; Bovill & Woolmer, 2020).

CONCLUSION

Effective teaching and learning still depend heavily on educational evaluation. Evaluation facilitates curriculum creation, informed decision-making, and better student outcomes by methodically evaluating the effects of programs, policies, and instructional strategies. A systematic method of assessing the efficacy of education is offered by the combination of models such as the CIPP framework and other forms of evaluation, including formative, summative, diagnostic, and ipsative. Although both modern and traditional tools are used in Nigeria, problems like a lack of financing and a lack of experience still exist. On the other hand, new developments like data analytics, AI-powered tools, and ongoing review present encouraging paths towards more thorough and responsive evaluation. Stakeholders must embrace innovation, make capacity building investments, and implement evaluation techniques in line with contemporary educational demands if they are to improve educational outcomes.

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