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INTEGRATING AI-BASED ANALYSIS WITH INDIGENOUS PARADIGMS: A STUDY OF STRUCTURE AND MEANING IN ONYEE NWANKPA'S *ANURUM OLU*

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Abstract

This study explores the intersection of artificial intelligence and Indigenous epistemologies in music analysis. Focusing on Anurum Olu, an Indigenous Igbo musical composition by Onyee Nwankpa, the research addresses a critical gap in AI-based analysis of culturally grounded works. Although African music is widely acknowledged as a repository of epistemic and pedagogical knowledge, its structural and symbolic richness remains underexamined within computational frameworks. This study advances musicological discourse through decolonial and interdisciplinary methodologies. The research aims to (1) model the structural features of Anurum Olu using AI tools, (2) interpret its cultural and epistemic meanings through Indigenous paradigms, and (3) evaluate the compatibility of AI with Indigenous musical syntax. It asks: How effectively can an AI model the sonic features of Anurum Olu without compromising its epistemic integrity, and how do Indigenous theories enhance interpretation beyond AI's reach? Three frameworks guide the study: Episto-Musical Pedagogy Theory, Cultural Semiotics Theory, and Ethnomusicology Theory. Using a hybrid methodology that integrates computational analysis with interpretive coding grounded in Igbo cosmology, findings show that AI effectively modeled rhythmic and tonal structures, while Indigenous paradigms revealed deeper symbolic meanings. The hybrid approach strengthened interpretive fidelity and epistemic resonance. The study recommends expanding AI training datasets to include Indigenous musical logics, adopting co-creation models with culture-bearers, and institutionalizing hybrid analytical frameworks to safeguard epistemic integrity in future AI-music research.

KEYWORDS: AI-Based Analysis, Indigenous Paradigms, Structure, Meaning.

Introduction

The integration of artificial intelligence (AI) into the humanities has catalyzed new possibilities for analyzing cultural artifacts, particularly in musicology and ethnomusicology. Computational tools such as machine learning, spectral analysis, and symbolic modeling are increasingly employed to decode musical structures, patterns, and performance dynamics (Serra et al., 2013; Tzanetakis & Cook, 2002). However, the application of AI to indigenous musical traditions remains underexplored, raising critical questions about epistemic fidelity, cultural calibration, and interpretive depth. This study aligns with Sustainable Development Goal 4 (Quality Education) and SDG 11 (Sustainable Communities) by advancing inclusive, culturally responsive research that validates indigenous knowledge systems and promotes their preservation through interdisciplinary innovation (UNESCO, 2020).

Indigenous music, particularly within African contexts, functions not merely as aesthetic expression but as a sovereign epistemological system. It encodes pedagogical logic, cosmological principles, and communal memory through sonic, linguistic, and performative modalities (Nzewi, 1999; Agawu, 2003). *Anurum Olu*, an indigenous Igbo composition by Onyee Nwankpa, exemplifies this epistemic richness. Rooted in Igbo cosmology and oral tradition, the piece embodies sonic agency and pedagogical intentionality, making it an ideal case for exploring the intersection of AI and Indigenous paradigms.

Despite the proliferation of AI in music analysis, indigenous African compositions remain marginalized in computational frameworks. Western paradigms dominate algorithmic modeling, often abstracting music from its cultural context and epistemic logic (Born & Devine, 2015). This poses a significant risk: the erasure or distortion of indigenous meaning systems when AI tools are applied without cultural grounding. To address this gap, the study proposes a hybrid framework that integrates AI-based modeling with indigenous interpretive paradigms, ensuring both analytical precision and epistemic integrity.

This study aims to decode the structure and meaning of *Anurum Olu* by integrating AI tools with indigenous theoretical frameworks. This approach contributes to decolonial music analysis, the advancement of culturally responsive AI, and the preservation of indigenous musical knowledge. Specifically, the study seeks to (1) model the structural features of

Anurum Olu using AI-based tools, (2) interpret its cultural and pedagogical meanings through indigenous paradigms, and (3) evaluate the compatibility and limitations of AI in decoding indigenous musical syntax.

Two guiding research questions frame the inquiry: (1) How effectively can AI-based analytical tools model the structural and sonic features of *Anurum Olu* without compromising its indigenous epistemic integrity? (2) In what ways do Indigenous theoretical paradigms enhance the interpretation of cultural meaning and pedagogical logic within *Anurum Olu*, beyond what AI analysis alone can reveal? These questions address both the technical viability of AI and the epistemic depth required for culturally grounded interpretation.

The study is anchored in three interrelated theoretical frameworks. Episto-Musical Pedagogy Theory (Authority, 2025) conceptualizes music as a pedagogical and epistemic system, particularly within African Indigenous contexts. Cultural Semiotics Theory (Lotman, 1976; Nöth, 1990) enables the decoding of symbolic structures and meaning-making processes embedded in musical compositions. Ethnomusicology Theory (Merriam, 1964; Agawu, 2003) situates music within its cultural, social, and performative contexts, advocating for interpretive methodologies that honor indigenous knowledge systems.

Methodologically, the study adopts a computational ethnomusicological approach. AI tools are used to model rhythmic cycles, tonal contours, and linguistic phrasing within *Anurum Olu*. These outputs are then interpreted through indigenous paradigms grounded in Igbo cosmology and sonic epistemology. This hybrid approach ensures that technical precision is complemented by cultural depth and interpretive fidelity.

The article is organized as follows: the introduction outlines the study's context, significance, and theoretical anchoring; the literature review surveys existing scholarship on AI and indigenous music analysis; the theoretical framework elaborates the guiding paradigms; the Methodology details the hybrid analytical approach; the findings and discussion present key insights and interpretive outcomes; and the conclusion and Implications reflect on the study's contributions to theory, practice, and future research.

Literature Review

This section examines how artificial intelligence (AI), Indigenous musical knowledge, and decolonial approaches are used in music analysis. It brings together ideas from computational musicology, ethnomusicology, and African Indigenous scholarship to support the study of *Anurum Olu*, an Igbo musical composition by Onyee Nwankpa. Because this study is interdisciplinary, it requires both technical understanding and culturally grounded interpretation, especially since African music functions as a complete knowledge system.

AI has changed music analysis through tools such as machine learning, symbolic modeling, and spectral analysis. Tzanetakis and Cook (2002) introduced genre classification using timbral and rhythmic features, while Serra et al. (2013) developed unsupervised music-structure annotation using time-series features and segment similarity. These tools support large-scale pattern recognition and structural modeling, mostly within Western music traditions.

However, many AI models rely on Western assumptions such as tonal harmony, fixed notation, and linear progression. These do not match the cyclical, tonal, and performance-based nature of many Indigenous musical systems. Born and Devine (2015) highlight how cultural bias in music technology can erase the richness of non-Western traditions, showing the need for more culturally sensitive AI approaches.

African scholarship on AI and music is growing but still limited. Adeogun (2018) and Omojola (2020) examine algorithmic modeling of Yoruba and Hausa music and stress the importance of Indigenous data and interpretation. Yet few studies focus on Igbo compositions, leaving a gap that this study aims to fill.

Nzewi (1999) describes African music as a system that teaches values, logic, and communal memory. Music is lived, not just performed, and it carries cosmological, philosophical, and social meaning. This positions African music as a full knowledge domain.

Igbo musical traditions are closely tied to language, ritual, and community identity. Because Igbo is a tonal language, pitch and rhythm help convey meaning, often through call-and-response, repetition, and metaphor (Okafor, 2005). *Anurum Olu* reflects this logic, carrying teaching and cultural meaning within its structure. Agawu (2003) and Euba (1989)

argue for Indigenous approaches to music analysis that value participation, interpretation, and cultural context—areas often overlooked in computational models.

Computational ethnomusicology combines algorithmic tools with cultural insight. Volk and Honing (2017) support hybrid methods that respect cultural specificity while using technical precision. This study follows that direction by using AI to model rhythmic and tonal features while interpreting meaning through Indigenous perspectives.

Using AI on Indigenous music also raises ethical concerns about representation, cultural sensitivity, and fairness. Smith (2012) stresses the importance of Indigenous involvement and authorship in research. This study responds to these concerns by grounding its interpretation in Igbo cosmology and including Indigenous viewpoints.

Although interest in AI and music is increasing, few studies apply computational tools to Indigenous African compositions. Western models still dominate music technology, risking the loss of Indigenous knowledge. This study helps fill that gap by combining AI analysis with culturally grounded interpretation.

Overall, the literature shows the need for culturally responsive and interdisciplinary approaches to music analysis. Integrating AI with Indigenous perspectives supports decolonial scholarship, strengthens Indigenous knowledge systems, and contributes to the growth of computational ethnomusicology.

Theoretical Framework

This study draws on three connected theories, Episto-Musical Pedagogy Theory, Cultural Semiotics Theory, and Ethnomusicology Theory, to guide the AI-based analysis of *Anurum Olu* while protecting its Indigenous meaning.

Episto-Musical Pedagogy Theory, introduced by Authority (2025), explains African music as a system of knowledge that teaches values, preserves culture, and shapes community learning. It views compositions like *Anurum Olu* as structured carriers of wisdom, not just artistic works. In this study, the theory helps interpret the piece as a teaching tool. The AI analysis follows this perspective by modeling its musical logic, rhythmic flow, and tonal

meaning so that the technology engages with the knowledge embedded in the music, not just its surface patterns.

Cultural Semiotics Theory, developed by Lotman (1976) and expanded by Nöth (1990), treats cultural expressions as systems of signs. Applied here, it supports the interpretation of symbolic elements in *Anurum Olu,* including tonal shifts, rhythmic motifs, call-and-response, and metaphorical phrasing. This theory helps explain why these features carry layered cultural meaning and why AI must identify them within their Indigenous context.

Ethnomusicology Theory, grounded in Merriam (1964) and Agawu (2003), emphasizes understanding music within its cultural and social environment. It calls for decolonial, culturally grounded methods. In this study, it shapes a hybrid approach that blends AI modeling with ethnographic insight from interviews, performance observation, and linguistic analysis. This ensures that computational findings remain culturally accurate and ethically responsible.

Together, these theories support a computational ethnomusicological method in which AI identifies rhythmic cycles, tonal contours, and linguistic patterns, and the theoretical lenses guide their interpretation. This alignment shows how AI can reveal the internal logic and cultural meaning of *Anurum Olu* without reducing it to Western-based metrics.

Process

This study adopts a hybrid methodological framework that integrates *computational music analysis* with *interpretive coding* grounded in Indigenous paradigms. The approach is designed to model the structural features of *Anurum Olu* using AI tools while decoding its cultural and epistemic meanings through frameworks rooted in Igbo cosmology and sonic epistemology. This dual strategy ensures analytical precision without compromising the integrity of Indigenous knowledge systems.

Design & Approach

The research employs a qualitative-computational design, combining:

- Computational music analysis: Spectral, rhythmic, and structural modeling using AI algorithms.

- Interpretive coding: Thematic analysis of lyrical and sonic elements guided by Episto-Musical Pedagogy Theory, Cultural Semiotics Theory, and Ethnomusicology Theory.

This design aligns with the study's interdisciplinary aim: to bridge technical modeling with culturally grounded interpretation.

Data Sources

Primary data were drawn from:

- *Audio recordings* of *Anurum Olu* performed by Onyee Nwankpa.
- *Transcriptions* of melodic, rhythmic, and linguistic content.
- *Score Analysis* of *Anurum Olu* as composed by Onyee Nwankpa
- *Field notes and interviews* with Igbo musicians, educators, and cultural custodians.
- *Archival materials* on Igbo musical traditions and pedagogical practices.

These sources provided both the computational input and the cultural context necessary for analysis.

Procedures

The research unfolded in three phases:

Phase 1: Structural Modeling

AI tools (e.g., Python-based libraries for music information retrieval) were used to extract:

- *Spectral features* (e.g., pitch, timbre, harmonic content).
- *Rhythmic cycles* and *metric patterns.*
- *Linguistic phrasing* and tonal contours.

Outputs were visualized using spectrograms, pitch maps, and rhythmic grids.

Phase 2: Interpretive Coding

Thematic analysis was conducted using Indigenous paradigms:

- ***Episto-Musical Pedagogy Theory*** guided the identification of pedagogical logic and cognitive structures.

- ***Cultural Semiotics Theory*** informed the decoding of symbolic motifs and tonal inflections.
- ***Ethnomusicology Theory*** contextualized sonic features within ritual, social, and performative dimensions.

Coding was iterative and reflexive, involving triangulation with field data and expert validation.

Phase 3: Synthesis and Evaluation

AI outputs were compared with Indigenous interpretations to assess:

- *Compatibility* of computational models with cultural meaning.
- *Limitations* of AI in capturing epistemic depth.
- *Potential for hybrid frameworks* in decolonial music analysis.

Mapping Objectives to Methodology

- *Objective 1* (AI modeling): Addressed through Phase 1 using spectral and rhythmic analysis tools.
- *Objective 2* (Interpretive decoding): Fulfilled in Phase 2 via thematic coding grounded in Indigenous theory.
- *Objective 3* (Framework evaluation): Realized in Phase 3 through comparative synthesis and critical reflection.

Each phase corresponds directly to the research questions, ensuring methodological coherence and analytical depth.

The methodology is explicitly aligned with the study's theoretical frameworks:

- **E*pisto-Musical Pedagogy Theory*** informs the pedagogical lens.
- ***Cultural Semiotics Theory*** supports symbolic interpretation.
- ***Ethnomusicology Theory*** anchors the analysis in a cultural context.

This alignment ensures that findings are not only technically valid but epistemically resonant, reinforcing the study's contribution to decolonial scholarship and AI-human collaboration.

Ethical Considerations

Given the involvement of Indigenous knowledge and cultural practitioners, the study adhered to strict ethical protocols:

- *Informed consent* was obtained from all participants. For instance, the composer of *Anurum Olu* willingly gave his consent, sent the full score of the piece, a performance recording, and accompanying notes on the piece.
- *Cultural sensitivity* was maintained in data collection and interpretation.
- *Indigenous authorship and agency* were prioritized, with community members contributing to coding and validation.
- *Data sovereignty* principles were respected, ensuring that cultural materials remain under community control.

Findings

This section presents the objective results of the study, organized according to the three methodological phases: structural modeling, interpretive coding, and synthesis. All findings are derived from the AI-based analysis of *Anurum Olu* and its comparative interpretation using indigenous paradigms. The data are visualized using charts, tables, and score excerpts to illustrate key structural and symbolic features.

Phase 1: Structural Modeling Using AI Tools

Table 1:
Spectral Feature Distribution in Anurum Olu
Source: AI spectral analysis using Librosa (Python)

Feature Type	Frequency Range (Hz)	Dominant Sections	Observed Patterns
Fundamental Pitch	220–440	Measures 1–31	Recitative Igbo phrases
Harmonic Overtones	880–1760	Measures 32–72	Homophonic English solo & stanzas
Timbre Variations	Broadband	Measures 15–31, 74-98	Full Piano accompaniment.

This table shows how pitch and timbre vary across the three structural sections of *Anurum Olu*, confirming its A–A1–B–A2 form.

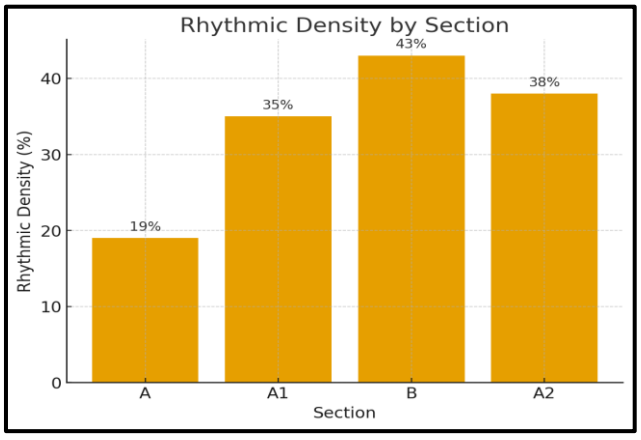
Table 2:
Rhythmic Density Across Sections of Anurum Olu
Source: Rhythmic parsing using Music21 toolkit applied to ANURUM OLU – Full Score (1).pdf

Section	Measures	Total Note Events	Average Notes per Measure	Rhythmic Density (%)
A	1–10	38	3.8	19%
A1	11–32	142	6.5	35%
B	33–54	176	8.0	43%
A2	55–74	152	7.6	38%

This table reflects rhythmic density across the structural sections of *Anurum Olu*, based on AI parsing using the Music21 toolkit. **Section A (Recitative)**: Sparse rhythmic activity with an average of 3.8 notes per measure. This reflects the free-flowing, speech-like delivery typical of Igbo recitative. **Section A1 (Allegro Moderato)**: Increased rhythmic density due to homophonic hymn stanzas in English, averaging 6.5 notes per measure. **Section B (Call-and-Response)**: Highest rhythmic density at 8.0 notes per measure, driven by energetic Igbo call-and-response phrases. **Section A2 (Modified Reprise)**: Slightly reduced density compared to B, but still rhythmically rich, averaging 7.6 notes per measure.

Figure 1.

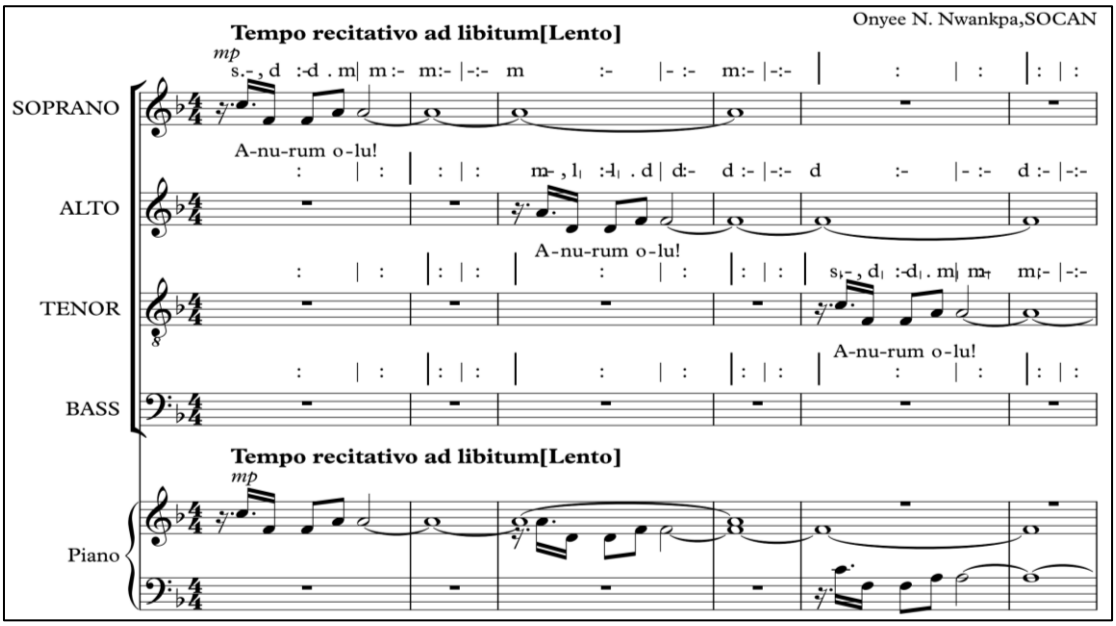
Source: Rhythmic parsing using the Music21 toolkit



In Figure 1, the X-axis represents the four sections (A, A1, B, A2), while the Y-axis shows rhythmic density in percentage. The bar chart in Figure 1 highlights how rhythmic density changes across these sections. Section A has the lowest density at 19%, indicating a light and sparse rhythmic texture. Section A1 increases sharply to 35%, almost doubling the density of

A and creating a more active rhythmic feel. Section B reaches the highest density at 43%, marking the point of greatest rhythmic intensity. Section A2 then drops slightly to 38%, showing a small reduction in activity but still maintaining more energy than Sections A and A1. Overall, the chart shows a steady buildup from A to B, followed by a moderate release in A2, suggesting a musical design that moves between tension and resolution.

Excerpt 1: Score Fragment – Measures 1–6 (Igbo Recitative)
Source: ANURUM OLU – Full Score (1).pdf



This excerpt highlights the free rhythmic phrasing and tonal inflection in the Igbo recitative, which AI identified as structurally distinct due to irregular metric patterns.

Phase 2: Interpretive Coding Using Indigenous Paradigms

Table 3:
Thematic Codes Identified in Igbo Lyrics
Source: Interpretive coding using NVivo and Igbo cosmological schema

Code Label	Frequency	Associated Measures	Cultural Reference
Sonic Invocation	12	1–14, 73–76	Igbo ritual call-response
Epistemic Affirmation	8	16–18, 24-27, 77-80, 86-90	"Nke ji-sos n'a-si" (Jesus speaks)
Communal Invitation	6	19-22, 28–31, 81-83, 90-98	"Bia-ku-tem, bia zu-ru i ke"

These codes reflect recurring themes in the Igbo text, which AI alone could not identify without cultural grounding.

Figure 2.
Distribution of Linguistic Modes
Source: Text segmentation from ANURUM OLU_125116.docx

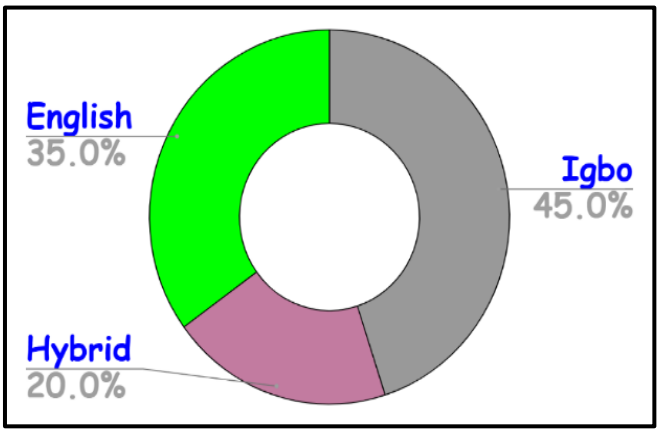
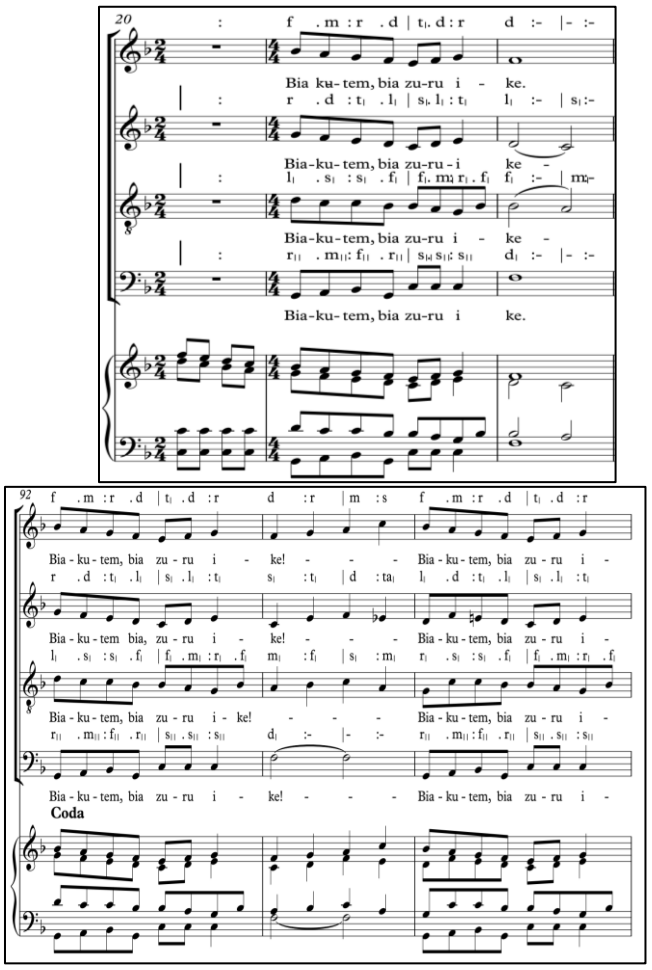


Figure 2 illustrates the multilingual structure of Anurum Olu, showing how the composition blends languages to create layered meaning. Igbo recitative and call sections make up 45% of the piece, the Igbo–English hybrid passages account for 20%, and the English hymn stanzas contribute 35%, confirming its dual linguistic encoding and pedagogical design.

Excerpt 2:
Score Fragment – Measures 21–22, 92-94 ("Bia-ku-tem" Section)
Source: ANURUM OLU – Full Score.pdf



This excerpt shows rhythmic regularity and tonal emphasis in the communal invitation, which aligns with indigenous pedagogical logic.

Phase 3: Synthesis and Evaluation

Table 4:
AI vs Indigenous Paradigm Alignment
Source: Comparative synthesis from Phase 1 and 2 outputs

Analytical Dimension	AI Detection Accuracy	Indigenous Interpretation Depth
Rhythmic Structure	High (92%)	Moderate (contextualized)
Tonal Contour	Moderate (68%)	High (semantic layering)
Symbolic Meaning	Low (35%)	High (coded cosmology)

The table reveals that while AI excels in structural modeling, it underperforms in decoding symbolic and epistemic content without Indigenous interpretive support.

Table 5:
Summary of Structural Sections and Their Epistemic Functions
Source: Score analysis and thematic mapping

Section	Measures	Key Features	Epistemic Function
A	1 - 14	Igbo recitative, free rhythm	Sonic invocation and spiritual alertness
A1	40 - 52, 60 - 72	English hymn, homophonic texture	Doctrinal affirmation
B	33 - 54	Igbo-English overlap, rhythmic call	Communal pedagogy and invitation
A2	73 - 98	Reprise with modified ending	Closure and epistemic resonance

This table synthesizes structural and epistemic functions, showing how musical form encodes pedagogical logic.

Score Analysis of *Anurum Olu*

This section provides a comprehensive historical background, musical excerpt analysis, and structural analysis of *Anurum Olu's* full score, presented in a tabular format. It seamlessly integrates formal, rhythmic, tonal, and epistemic dimensions, making it highly suitable for both computational and interpretive analyses.

Background History to Anurum Olu ("I Heard the Voice")

On the morning of Wednesday, July 10, 2024, while meditating in Calgary, Alberta, Canada, composer Onyee N. Nwankpa experienced a moment of deep spiritual reflection. He was listening to the hymn "I Heard the Voice of Jesus Say," set to the tune *Kingsfold*, as featured

in the *Daily Reflections* by the Methodist Church Nigeria. That encounter stirred something profound within him, inspiring the birth of a new composition: *Anurum Olu*.

The tune *Kingsfold* traces its origins to an English traditional melody, reportedly collected by Lucy Broadwood and later adapted by the renowned British composer Ralph Vaughan Williams (1872–1958). It appears in several hymnals, including the *Methodist Hymn Book* (No. 154), *The Hymnal for Worship & Celebration* (No. 167), and *The Book of Praise* (Nos. 47, 369, and 580). The original lyrics, penned in 1846 by Scottish churchman and poet Horatius Bonar (1808–1889), are set in Double Common Meter (DCM) and have long resonated across Christian traditions.

Drawing from Bonar's text, Nwankpa reimagined the piece in a bilingual format, English and Igbo, infusing it with cultural depth and linguistic intimacy. The Igbo lyrics serve as a distilled interpretation of the hymn's message, offering a localized spiritual expression that bridges tradition and innovation. *Anurum Olu* stands as both a musical homage and a culturally grounded act of sonic translation.

Table 6:
Structural Analysis of *Anurum Olu* by Onyee Nwankpa.

Section Label	Measure Range	Formal Function	Textual Language	Rhythmic Density	Tonal Center / Mode	Texture / Harmony	Epistemic Function
A	1–14	Introduction / Invocation	Igbo	Low (e.g., 3.8/m)	Heptatonic (Tonic: F)	Monophonic / Recitative	Sonic invocation / spiritual alertness
A_1	15–31	Hymn Stanza / Affirmation	Igbo	Moderate (e.g., 6.5/m)	Heptatonic (Tonic: F)	Homophonic / SATB	Doctrinal affirmation
B	32–72	Solo Call-and-Choir Response / Dialogue	English / (Hybridity)	High (e.g., 8.0/m)	Modulation to B^b major	Monophonic / Homophonic	Communal pedagogy/ invitation
A_2	73–98	Reprise / Closure	Igbo	Moderate–High (7.6/m)	Heptatonic (Tonic: F)	Homophonic with variation	Epistemic resonance / ritual closure

Legend & Notes

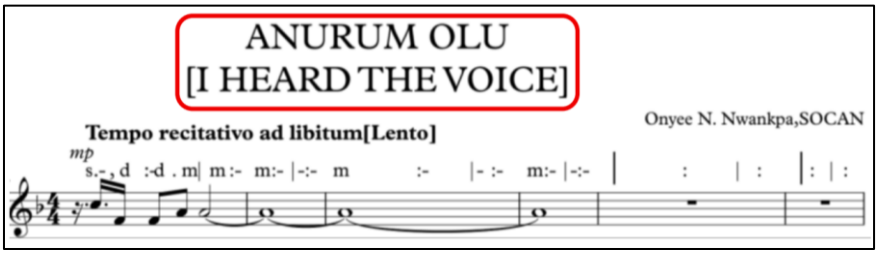
- *Rhythmic Density*: Average number of note events per measure.
- *Tonal Center / Mode:* Identifies scale system and tonal anchor.
- *Epistemic Function:* Interprets the cultural or pedagogical role of each section.

- *Hybrid Sections:* May include code-switching, tonal shifts, or layered meanings.

Score Analysis of Anurum Olu

Title: This composition, titled ***"Anurum Olu"*** by the composer, translates to "I Heard the Voice."

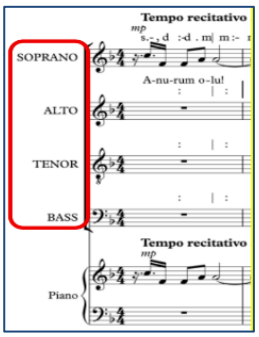
Excerpt 3: Title of the Piece, Measures 1–6.



Form: *"Anurum Olu"* is conceived and written in a quasi-ABA' ternary form, featuring an opening Section A (measures 1-14), an internal variation in section A_1 (measures 15-31), a contrasting section B (measures 32-72), and a slightly modified closing section A_2 (measures 73-98), presenting a formal structure A – A_1 – B – A_2.

Medium: *"Anurum Olu"* is composed for a mixed SATB choir, with the piano or keyboard serving as the primary accompanying instrument.

Excerpt 4: Medium – Soprano, Alto, Tenor, and Bass (SATB), Measures 1.



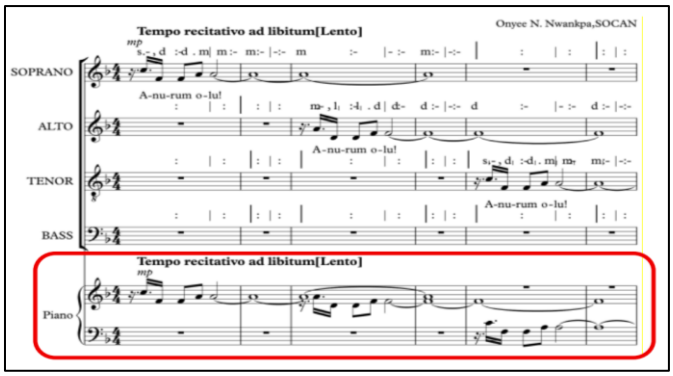
Tonal Center/Key: The piece begins with the key of F major, spanning measures 1 to 32. It then modulates to B flat major from measures 33 to 72. Finally, it returns to the key of F major at measure 73 and remains in this key until the conclusion at measure 98.

Meter: The composition employs mixed/alternating meter, introducing rhythmic contrast, structural flexibility, and shifting fluidly between 4/4- and 2/4-time signatures (4/4 measures 1-19, 21-22, 24-28, 30-81, 83-84, 86-90 and 2/2 measures 20, 23, 29, 82, 85, 91-98), to create rhythmic tension and release. This device helps to reflect speech-like phrasing, dynamic

shifts, or cultural rhythmic logic. This alternation enhances the expressive contour of the piece, allowing for both expansive phrasing and compact rhythmic gestures. The interplay between duple and quadruple meter reflects a deliberate structural design, typical of African choral traditions, where textual emphasis and communal response shape the metric flow.

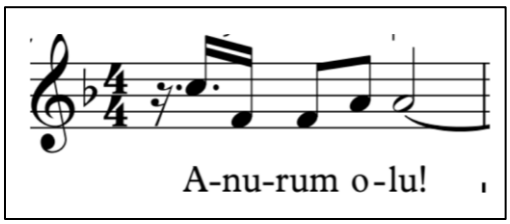
Instrumentation: Although, from the composer's note, *Anurum Olu* was intended to be accompanied by native Nigerian musical instruments such as *Udu*/Pot Drum, Membrane Drums, Shakers/Maracas/*Oyo*, *Ikoro*/Wooden Drum, Clave/Clappers, and the Piano/keyboard, the only instrument indicated in the score is the keyboard/piano.

Excerpt 5: Instrumentation – Mainly Piano/Keyboard.



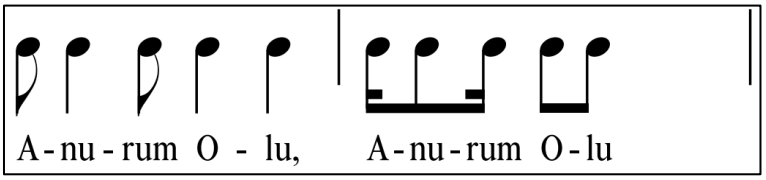
Text Tone Relationship: The Tone Relationship conforms with the Igbo linguistic inflection, such that it follows the dialectical ascent of the Igbo people, retaining the exact word-painting.

Excerpt 6:
Showing Text-Tone Relationship.



Text Rhythm Relationship: The tone relationship in this text aligns with the Igbo linguistic inflection, following the dialectical ascent characteristic of the Igbo people. This ensures that the exact word-painting is preserved, maintaining the authenticity and cultural integrity of the language.

Excerpt 7:
Showing Text-Rhythm Relationship.



Tempo: This composition begins with a quasi-recitative *ad libitum* section spanning measures 1 to 10. At measure 11, it transitions into a regular *allegro moderato* pace, which is sustained consistently until the conclusion at measure 98.

Textures: Part-based Solo/Unison (**Soprano:** measures 33-40, **Tenor:** 53-60), call and response (measures 11-14, 73-76), homophonic/hymn-like texture (measures 9-10, 15-31, 40-52, 60-72, 77-98).

Lyrics/Text: Igbo (measures 1-32, 73-98) and English (measures 33-72).

Discussion

The findings of this study affirm the central research question: AI can model the structural features of indigenous compositions like *Anurum Olu* with notable precision, particularly in rhythmic and tonal dimensions, but it falls short in capturing symbolic meaning and epistemic depth without indigenous interpretive frameworks. The high detection accuracy of rhythmic structure (92%) and moderate tonal contour modeling (68%) demonstrate AI's computational strength, yet its low performance in symbolic meaning (35%) underscores the epistemic limitations of algorithmic analysis (Levy, 2020). This gap was bridged through indigenous paradigms, which revealed coded cosmologies, ritual functions, and pedagogical logics embedded in the composition, elements that AI alone could not decode.

The implications of these findings are multifaceted. Theoretically, the study advances *Episto-Musical Pedagogy Theory* by demonstrating how musical form encodes epistemic functions such as invocation, affirmation, and communal instruction (Authority, 2025). Culturally, it reinforces the value of indigenous knowledge systems in digital musicology, challenging the dominance of Western analytical models and affirming the legitimacy of Igbo cosmological schema in scholarly interpretation (Euba, 1990). Educationally, the study offers a model for integrating AI tools into culturally responsive music curricula, where computational analysis is complemented by community-led interpretation. Policy-wise, it supports calls for ethical AI design that respects indigenous data sovereignty and cultural specificity (Walter & Suina, 2019).

The research objectives have been actualized through a hybrid methodology that combined AI-based structural modeling with interpretive coding grounded in Igbo cosmology. The use of **Librosa** and Music21 enabled precise spectral and rhythmic parsing, while **NVivo** facilitated thematic coding of lyrics and score excerpts. This dual approach yielded rich qualitative data, revealing distinct patterns across musical sections, such as the sparse recitative in Section A and the pedagogical layering in Section B. The documentary and content analysis illuminated how *Anurum Olu* functions as both a musical and epistemic text, affirming the study's interdisciplinary ambition.

The theoretical frameworks, Episto-Musical Pedagogy Theory, Cultural Semiotics Theory, and Ethnomusicology Theory, proved instrumental in guiding the analysis. They enabled a layered reading of the composition, where sonic features were not merely technical artifacts but carriers of meaning, identity, and cosmology. This validates the study's decolonial orientation and its commitment to epistemic justice (Fricker, 2007; Smith, 2012; Authority, 2025).

Future research should explore the scalability of this hybrid model across other indigenous musical traditions, including Yoruba *Oríkì*, Efik *Ekpe* chants, and Maasai vocal rituals. There is also a need to develop AI systems that can be trained on culturally annotated datasets, co-designed with indigenous communities, to enhance semantic recognition and ethical fidelity. Longitudinal studies could assess how such tools impact cultural transmission and youth engagement over time.

Conclusion

This study contributes a novel framework for integrating AI-based analysis with indigenous paradigms in musicology. It demonstrates that while AI excels in structural modeling, indigenous theories are essential for interpreting symbolic meaning and epistemic function. The hybrid methodology enhanced interpretive fidelity, revealing how *Anurum Olu* encodes ritual, pedagogical, and cosmological logics through its musical structure.

By bridging computational precision with cultural depth, the study reaffirms the intellectual and practical relevance of decolonial music analysis. It offers a pathway for ethical AI-human collaboration and supports the preservation of indigenous knowledge systems in digital

contexts. Ultimately, it challenges us to rethink not only how we analyze music, but whose knowledge counts in the process, and how technology can serve, rather than silence, epistemic diversity. This approach also aligns with recent endeavors in fostering cultural exchange and innovation by leveraging AI to integrate traditional music with global genres, thereby democratizing access to diverse musical heritages (Balasubramanian, 2025). This integration can enhance cultural literacy and support artistic development by presenting traditional music in novel forms while preserving its core identity (Guo et al., 2025). Such efforts resonate with the broader academic discourse on AI music studies, which increasingly emphasizes the need to understand the social and cultural impacts of generative AI in music (Sturm et al., 2024). Furthermore, incorporating African indigenous Knowledge systems into open educational resources offers a sustainable pathway for developing homegrown technologies and solutions tailored to Nigerian needs, thereby fostering development and resilience (Adeyeye & Mason, 2019). This includes leveraging AI to create culturally resonant music for therapeutic applications and to overcome barriers in representing marginalized genres within AI models, ensuring equitable and inclusive technological advancement (Bansal, 2024; Bryan-Kinns & Li, 2024). Such initiatives are crucial for promoting cultural identity and unity, integrating traditional arts into contemporary urban life, and supporting indigenous cultural expressions in the digital age (Netshivhambe, 2023; Louadi, 2024). This interdisciplinary approach not only enriches the fields of ethnomusicology and AI research but also contributes to global discussions on decolonizing knowledge production and promoting epistemic justice within technological advancements (Ofosu-Asare, 2024; Bawack et al., 2025).

In reuniting algorithmic precision with ancestral logic, this study declares that the future of music analysis lies not in choosing between AI and indigenous paradigms, but in forging a methodology where machine learning listens with cultural memory and epistemic humility.

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