MATERIAL MATTERS: THE ACOUSTIC PROPERTIES OF NON-TRADITIONAL AGIDIGBO CONSTRUCTION

***ADEYEYE, Adegorioye O & OKEDAIRO, Olufemi O.**
Department of Music Technology, The Federal Polytechnic Ilaro, Nigeria
*Corresponding author:**adegorioye.adeyeye@federalpolyilaro.edu.ng**

ABSTRACT
This research explores the acoustic characteristics of non-traditional Agidigbo musical instruments. The construction of the Agidigbo, a traditional musical instrument from Nigeria, has changed over time, with its construction usually consisting of local materials, precisely wood. This research explores the acoustic effects of using unconventional materials and methods to fabricate Agidigbo. The study presents an analysis of conventional and non-traditional construction methods with an emphasis on acoustic properties such as frequency/pitch, resonance and tonal quality. Using standardized acoustic and musical techniques, Agidigbo prototypes are tested as part of the research methodology. The results show that traditional and non-traditional Agidigbo construction have significantly different acoustic properties, demonstrating the impact of materials on sound quality and output. The results further our knowledge of the connection between material selection and acoustic performance in the building of musical instruments. This research offers insights into optimizing Agidigbo construction for improved acoustic performance, while maintaining traditional workmanship, which has significance for musicians, instrument makers, and cultural preservationists.

Keywords: Agidigbo, Musical instrument, Acoustic Properties, Non-Traditional.

1.0 INTRODUCTION

Within many Nigerian communities, the Agidigbo, a traditional musical instrument, has great cultural value. The Agidigbo is crafted by expert artisans utilizing native materials and customary methods, is more than just an instrument; it represents the cultural legacy, narrative, and communal identity (Euba, 1985). Fabricating the Agidigbo has historically relied on locally produced materials including omo wood, malina wood, metal plates, and bolts and nuts to fasten the metal keys to a bridge on top of the musical instrument. These components are carefully chosen for the instrument's acoustic qualities, which add to its distinct sound qualities. The Agidigbo's rich tones are mostly produced by the resonance properties of its wooden main body and the flexibility of its metal plates (Agawu, 2003). Nevertheless, modern issues, like shifting resource availability and cultural dynamics, have forced Agidigbo builders to experiment with non-traditional building materials (Falola & Genova, 2018). This change begs interesting concerns regarding how such modifications impact the acoustic characteristics and overall sound quality of the instrument. Thus, the main inquiry guiding this investigation is what impact do unconventional materials have on the Agidigbo's acoustic characteristics? Our goal in answering this question is to investigate how modernity and material innovation have affected this culturally significant instrument's sound and its identity.

This research aims to advance knowledge of the connection between material selection and acoustic performance in the construction of musical instruments by first examining the acoustic effects of using non-traditional materials in Agidigbo construction. Through an analysis of conventional and unconventional building techniques, we aim to clarify the intricate relationship among cultural customs, material science, and musical acoustics. This research will offer insightful information to musicians, instrument makers, and cultural preservationists who are trying to build the Agidigbo while balancing tradition and modernity.

Various factors influence the sound production of the Agidigbo including its shape, size, and choice of materials. This was corroborated by Akere, (2023), who describes the Agidigbo as a traditional musical instrument with four equal-length and-width sides shaped like a rectangular box. It has a base and a soundboard with a perforated sound-hole. Akere opines that the construction of Agidigbo is influenced by several crucial elements, including the resonance cavity, wall thickness, material length, and material qualities. Moreover, Agidigbo's ability to produce sound is greatly influenced by the dimensions, form, and material qualities of the resonator wall. These emphasize how crucial it is to give these variables serious thought during the design and building of Agidigbo instruments to obtain the best possible structure and sound quality. The use of composite materials, 3D-printed materials, and metamaterials as substitutes for conventional wood in the production of musical instruments was also examined by Brezas et al. The researchers investigate manufacturing processes, vibrational and acoustical evaluations, and experimental and numerical simulation approaches in addition to discussing the benefits of these materials, which include durability, weight reduction, and adjustable acoustics. Brevas et al (2024). In line with this approach of substituting traditional materials with modern ones, this research explores the acoustic implications of the use of Medium-density Fiberboard and High-density fiberboard for the construction of the acoustic body of the Agidigbo.

Bucur (2016) explored the development of composite materials to replace wood in musical instruments, with a focus on the characteristics of nano-composites and composites reinforced with natural and synthetic fibers, as well as the advantages and disadvantages of fiber-reinforced composites. Along with offering instances of effective uses of composite materials in the production of musical instruments, looking at the standards for matching the qualities of composite materials to those of conventional wood. There has been researches that identified substitute materials for the construction of musical instruments, with a focus on the acoustic characteristics of modified wood materials under various humid circumstances. That is, wood that has been heat-modified and acetylated with melamine among other materials that have been examined by Ahmed and Adamopoulos (2018). The findings indicate that a few of these materials have acoustically promising qualities that could make them viable substitutes for conventional tropical wood species. Akere, (2023) investigates the technological innovation of the traditional Agidigbo musical instrument from a conceptual and theoretical standpoint. The researcher talks about the various varieties of Agidigbo, its construction, and design, and how crucial it is to take the acoustic qualities of the materials into account. The study suggests evaluating the impact of conservation materials on the sound and identity of Agidigbo musical instruments. In the case of this research, there is the exploration of the implication of unconventional materials on the sound of the Agidigbo.

2.0 METHOD

The method adopted for this research is experimental design approach. Many Agidigbo prototypes were built for the experimental design, each with a different non-traditional material, but all with the same basic size and design. The process started with the selection of suitable non-traditional materials and continued with the normal metalworking and woodworking procedures to fabricate the Agidigbo. Throughout the building process, great care was taken to maintain the instrument's structural form and functional features. The techniques used for assessing the acoustic properties of the non-traditional materials are:

Resonance Frequency/Pitch Response: The basic resonant frequencies of the traditional and non-traditional Agidigbo prototype were tuned and measured using an electronic tuner app. The primary resonant frequencies and harmonic content of the musical instruments were ascertained by analyzing the frequency response that was produced when played.

Wood Grain Analysis: To evaluate the structural strength and acoustic qualities of the non-traditional materials used in Agidigbo construction, a visual examination was carried out, and a pressure test was carried out on the materials. To determine how grain density, orientation, and uniformity affected resonance properties and sound transmission, these factors were assessed.

This research aims to thoroughly assess the acoustic characteristics of non-traditional Agidigbo structures and contrast them with their traditional counterparts by using these measuring methodologies. The comprehensive investigation of material influences on resonance, sound quality, and overall instrument performance was made possible by this methodology.

NON-TRADITIONAL MATERIALS USED

There are three major unconventional materials used for the construction of the Agidigbo in the course of this research, and they are the Medium-density fiberboard (MDF) plywood, high-density fiberboard (HDF) plywood, and the galvanized metal plate for the keys of the Agidigbo. Medium-density fiberboard (MDF) Plywood was used as the first sample for the construction of the Agidigbo body. Medium-density fiberboard (MDF) plywood was used due to its consistent density and stability, while the High Density Fiberboard (HDF) Plywood, offers greater durability and resonance due to its denser composition compared to conventional wood products. Galvanized Metal was however used for making the Keys galvanized metal keys were used in place of conventional iron metals.

ALTERNATIVE MATERIALS USED FOR CONSTRUCTION

Medium-density fiberboard, or MDF, and high-density fiberboard, or HDF, are two terms that have become widely used in modern woodworking. Crafted by fused wood fiber and adhesive at high pressure and temperature, they present a strong alternative to real wood. Because they are made of recycled materials and are durable due to high compression, they are an eco-friendly and sustainable option for modern construction methods. Although HDF is structurally stronger than MDF and serves the purpose of making bigger musical instruments. Even while MDF might not be as strong as HDF, it is still rather resilient and does not expand or contract as a result of changes in humidity and temperature. Different MDF types serve particular purposes and increase adaptability. Notable benefits of fiberboard are its ease of manipulation and pest resistance. However, it's important to take a few factors into account when deciding between MDF and HDF for the construction of the Agidigbo. The downside of MDF and HDF compared to natural wood is that both have worse holding strengths. This is especially significant when used to construct musical instruments that need to be assembled frequently. Although, Agidigbo as discussed in this research is a box-shaped musical instrument with fixed structures. They should therefore not be used outside because of their susceptibility to moisture or water exposure, which can cause fiber swelling and permanent damage.

Key informant trimming the wood to shape.

MDF and HDF wood in sizes to be trimmed for Agidigbo making.

ACOUSTIC IMPLICATIONS OF USING MDF/HDF FOR MUSICAL INSTRUMENTS CONSTRUCTION

When building musical instruments, real wood versus MDF/HDF presents important acoustic considerations. Because of its special acoustic qualities, real wood, prized for its inherent resonance and tone richness has long been the preferred material for instrument fabrication. On the other hand, MDF and HDF performed differently in terms of acoustics and they provide consistency and durability in structure. Compared to instruments made of actual wood, their solid and homogeneous composition tends to absorb vibrations the right way and prevent the passage of sound waves that could have resulted in unnecessary echo and elongation of tones during performance of the instrument. Furthermore, MDF/HDF's absence of inherent grain patterns and variety might result in a more uniform sound that lacks the character and depth that players look for in their instruments when used for constructing instruments such as guitars, violins, or pianos, but for the Agidigbo, the box-shaped structure exhibits a better sound production compared to the wooden Agidigbo.

However, certain artists are now able to investigate the use of engineered materials, such as MDF/HDF, in combination with other materials to produce particular tonal characteristics, sustainability, technological breakthroughs and improvements in instrument manufacturing procedures. However, the community that creates musical instruments continues to discuss and experiment with the acoustic effects of these decisions. In the end, the acoustic trade-offs must be carefully considered against the desired sonic attributes and creative vision of the instrument manufacturer and musician, even though MDF/HDF may give practical advantages in terms of consistency, durability and affordability.

FINDINGS

The evaluation of acoustic characteristics' results offers fascinating new information about how differently built Agidigbo instruments function to their wooden equivalents. Surprisingly, the non-traditional Agidigbo prototypes demonstrated a clearer, more consistent sound profile with improved projection and clarity. The non-traditional prototypes showed better longevity and tolerance to environmental conditions than the traditional timber Agidigbo instruments, which are prone to insect infestation and deterioration if not properly managed. The instruments' structural integrity and endurance were enhanced by the principal construction materials of MDF and HDF plywood, which reduced the possibility of damage and deterioration over time. Moreover, the substitution of conventional metal keys with galvanized metal keys was beneficial in reducing corrosion and rust-related problems. The metal keys demonstrated resistance to moisture and temperature changes in the surroundings, guaranteeing dependable operation and an extended lifespan of the instrument's key mechanism. Sound quality and resonance characteristics of traditional and non-traditional Agidigbo buildings were found to differ significantly. The higher acoustic performance of non-traditional prototypes was regularly demonstrated by their stronger tonal definition and sustained resonance throughout a wider frequency range.

Overall, the findings demonstrate the potential advantages of using unconventional materials and techniques to improve Agidigbo instruments' longevity and acoustic qualities. Instrument builders can overcome historical constraints while maintaining the people's cultural integrity and distinctive musical identity by utilizing contemporary and easily accessible materials and techniques.

Source: Field work

Source: Field work

Source: Field work

DISCUSSION

Examining the findings in light of the research topic highlights how important material selection is in determining the acoustic characteristics of Agidigbo instruments. The results show that non-traditional building techniques, which make use of materials like MDF and HDF plywood, have clear benefits about sound quality, longevity, and resistance to environmental influences. This is consistent with the main goal of the research, which is to determine how unconventional materials impact the Agidigbo's acoustic characteristics. These findings have a wide range of consequences for Agidigbo construction and music-making. First off, using non-traditional materials offers a chance to solve problems that come with using traditional wooden construction, like its vulnerability to decay and insect infestation. Instrument manufacturers are now able to create Agidigbo instruments that not only survive environmental challenges over time, but also retain consistent performance by integrating materials with increased durability and stability. Moreover, the use of unconventional materials creates opportunities for Agidigbo design innovation and personalization. The capacity to explore diverse material compositions and manufacturing methods empowers craftspeople to customize instrument attributes to particular musical inclinations and performing scenarios. This adaptability enables musicians to experiment with new tonal possibilities and expressiveness in their compositions.

However, it's critical to recognize the study's shortcomings and provide possible directions for further investigation. The emphasis on a small number of unconventional materials, which might not cover all the options for the Agidigbo building, is one drawback. Subsequent research endeavors may investigate an expanded array of materials to enhance comprehension of their acoustic characteristics and appropriateness for use in the creation of musical instruments. Although the study offers insightful information about the acoustic performance of non-traditional Agidigbo constructions, more investigation is required to evaluate other factors including playability, ergonomics, and cultural significance. We could gain a deeper knowledge of the intricate interaction between material culture, tradition, and musical expression in the context of Agidigbo fabrication by incorporating multidisciplinary viewpoints from the fields of anthropology, material science, and musicology.

CONCLUSION

Conclusively, this research highlights the significance of material selection in determining the acoustic qualities and functional traits of Agidigbo as a unique African musical instrument. Music technologists and Instrument manufacturers can develop while maintaining the acoustic character and cultural legacy of this beloved musical instrument by utilizing contemporary materials and construction methods, thereby easily navigating the stress of sourcing for traditional materials that are not easily accessible due to scarcity of specific wood types resulting from urbanization and development.

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