traditional musical instruments should do in the future to let it stay inline in this globalization era.

Keywords: Exploration, Innovation, Instrument, Technology, Traditional Music.

Introduction

Every society has its musical instruments with which it is identified and known. In spite of marginalization, westernization and industrialization, there is still an internal aspiration in every culture or traditions for her artistic posterity amidst the obscuring effects of industrialization. In the past, some musical instruments were discovered by artists through excavations, and this served as source or hints for recognizing and associating them with societies from where the discoveries were made. Music and technology are two indispensable words, meaning that they cannot be over emphasized by music scholars and researchers as it deals with the construction of musical instrument which this research tend to focus on.

In recent times, traditional musical instruments are not spun out in the technology use in-line with today's technology advancement. A number of Nigerian musicians have innovated traditional musical instruments using modern technology which can be described as robotic musical instruments (Kenechukwu, 2020). Robotic musical instruments are either use to make more interesting music performance and to build an everlasting crew that can play with musical artists (Kapur, 2005; Annuar, 2021). Generally, the innovation are often centered on modern or western musical instruments but hardly ever on traditional instruments (Leng, Norowi & Jantan, 2018) and a large number have thrived in performing the innovation instruments (Damkliang, Thongnuan & Chanlert, 2012). For that reason, the call for technological innovation in Nigeria traditional musical instruments is indispensable which can unite the past with the future, aid in safeguarding, creating more opportunities to show them on the international level and for the purpose of education. Though, there are conventional musical instruments that are used together with technology, but nearly all of them use a virtual application that uses the least cost. Several studies demonstrate that the use of such technology as an instructive approach has positive attitude on user's understanding, interest and knowledge of traditional

musical instruments (Simeon, 2015; Wiguna, 2019; Annuar, 2021). Study carried out on the use of technology on real Nigeria's traditional musical instruments is inadequate. Therefore, a scoping assessment was carried out to review the latest published research that using real instruments besides interactive applications and replicated instruments found among the review studies.

Literature Review

Concept of Technology and Nigeria Traditional Musical Instrument

The word technology is a Greek language which means 'Techno' meaning "art and craft", with logos "word speech", meant in Greece, a discourse on the arts both fine and applied. In the narrow sense, technology refers to the industrial processes that succeeded craft operations (Ajiboye & Akere, 2019). In the broader sense it refers to all process dealing with materials. Technology in respect to science is defined according to advanced learner's dictionary (2000) as a scientific knowledge used in practical ways in industry. Adeleke (2012) opines that technology helps to make people to be more productive and free to explore. Ajiboye and Akere (2019) state that technology in away has penetrated into music science and thus bringing us to defining the term music technology as the act of applying scientific and engineering materials to satisfy human basic need of music entertainment. Music technology is the production and creation of sound through scientific or technological devices (for music production in the musical studio and musical video recording) as well as having to do with the construction of musical instruments and the basic principles guiding it. One important aspect of music technology is musical instrument. Musical instrument is the branch of music technology that deals with the production, repair, fabrication or construction and maintenance of musical instruments as well as bringing us to the knowledge of the instruments family (Ajiboye & Akere 2019). This branch also deals with the basic principles guiding the construction of any musical instrument.

Nigeria, like other Africa countries, has a wide variety of traditional musical instruments. Nigeria has a rich heritage of traditional instruments although for a long time, the impression created by early travelers was that drums were the predominant musical instruments (According to Inanga & Soyanno 1991). While it is true that drumming plays an important role in Nigerian

music. The Nigerian indigenous instruments perform musical, communicative and religious purposes. These include announcements, directing performers or dancers on the next step to take, for religious worship, as accompaniments to singing groups, for orchestral indigenous music, as solo instruments, as rhythmic instruments that play regular time patterns as metronome giving ostinato effects. Ofuani (2011) states that some Nigerian musical instruments that are prevalent in the workshop-market are: xylophone (the double-slab and multislab types), wooden bells (‘okpokolo’ slit drums (ekwe/ikoro), metal bells (alo, ogene etc.), ‘mgbiligba’(bell), ogenephone, wooden rattles, calabash/gourd rattles, basket rattles, musical pots (the foam-pad and the hand beaten types), varieties of membrane drums (‘igba’) bongo, ogwe etc.), thumb-piano, the Igbo people’s wooden flute (‘oja’).

Generally, Nigeria traditional musical instruments can be categorized into four main divisions, namely; idiophones, membranophones, aerophones, and chordophones (Onwuekwe, 2011; Okpara 2016). Idiophones are resonating percussion instruments made from resonating material that does not have to be tuned e.g. gong, xylophone (Microsoft Encarta, 2007). The slit drum found in tribal cultures is also an idiophone. Idiophones are the instruments that produce sound by the vibration of the entire bodies (Nwafor 2010). It is made of a tree trunk hollowed out through a narrow stick. The bell is a musical percussion instrument, a hollow cup-shaped vessel, usually made of metal but sometimes made of wood, pottery (pot drum), or other material that produces sound. Pot gong (drum) is made of bronze. The simplest ensembles have four or five pot gongs tuned to different pitches. Xylophones come from the Greek word xylon (wood), phone (sound). It is a musical percussion instrument consisting of a series of graduated wooden bars that are struck with mallets, to provide sound. Shaken idiophones are instruments that are shaken. An example is rattle or maracas. Idiophones are played by hitting, shaking or plucking. Examples are: struck idiophones (e.g. pot drum (udu), slit-wooden drum (ekwe), bells or wooden gong (ogene), xylophone (ngedegwu); shaken idiophones (the rattle) and plucked idiophones (‘ubo’ aka (thumb piano).

Skin drums are called membranophones because sound is produced from them by the vibration of stretched membrane. Drums are classified as

membranophones because their sound is produced by vibrating a membrane (Microsoft Encarta 2007). It consists of a skin tied over the top and pierced by a stick. Examples are conga drum, talking drum, tambourine etc. Conga drum is a long, narrow drum played with the palm of the hand and fingers. Tambourine is a small frame drum that is constructed of a single membrane stretched over a circular rim, which usually has metal jingle disks attached to it. It can be played in three different ways: tapping the membrane with fingers, shaking the instrument, or striking it against the body. Nwafor, (2010) states that membranophones are instruments that use leather or membrane covering at one or two drum-heads.

Aerophones are available traditional instruments that consist of flutes, horns and trumpets.These instruments are played by blowing air into them e.g. local flute (oja), Hausa reed (aligaita), Hausa trumpet (khakaki). They produce sounds by the vibration of the air column (Onwuekwe, 2011). Chordophones or string instruments are instruments made of strings or cords and are played by plucking e.g. Hausa violins such as 'goje', 'gurmi' and Igbo zither (ubo akwara). From the discussion so far made, it is known that Nigerians have a wide variety of traditional musical instruments ranging from idiophones (self-sounding instruments), membranophones, (instruments that produce sounds by the vibration of stretched membranes), aerophones (indigenous windinstruments) and chordophones (strings/plucked instruments).

Conceptual and Theoretical Review

Two main models are used for this study. The first is the transformative conceptual framework proposed by Adedeji (2006), says that transformative musicology is the musicology that aims at the transformation of our environment and our world at large. It encompasses all musical activities that focus on transformative purposes (Adedeji, 2006). In his application, Adedeji observed that following inadequacy or failure of existing systems, musical studies and activities need to be re-contextualized to meet contemporary challenges and made relevant to contemporary societal needs. In addition, theory of continuity and change propounded and first used by Herskovits and Bascom (1975). The main point the theory is arguing out in the context of this work is that the tradition of our people should continue but with improvement taking the

advantage of technology in face-lifting the quality of our end product in terms of construction and this would bring about good change. The theory has also been used by many scholars like Blacking (1978), Alaja-Browne (1989), Adegbite (1992), Okunade (2005) and Samuel (2005).

This paper is opines that the Nigeria culture of strict specialization in such local art, as instrument playing and construction is a key issue when changes in contemporary world music order is articulated. For further discussion on native concept of musical instrument in Nigeria, Omojola (2006) noted that Nigerian musicians usually belong to families that have been specially identified by the prediction to continue the country tradition and have a long tradition of specialist musicians. However, many people have developed interest in the playing and constructing of the traditional muscial instrument as a vocational work. This position suggests a transformative approach to conceptualizing Nigerian traditional musical instrument in terms of design, aesthetics, construction and usage through modern technological process of construction.

Methodology

This study adopted the methodology framework by Arksey and O'Malley (2005) which was used to summarize research findings and identify the research gaps in the existing studies. The framework consists of five stages for conducting the scoping review, which is identifying the research questions, identifying most related studies, study selection, charting the data, and collating, summarizing, and reporting the results. The review studies were selected based on few research questions, "How technological innovation can be applied to traditional musical instruments?" and "What are public responses toward the use of technology in traditional musical instruments?" Searching for research evidence was done using electronic sources and was conducted in the database Scopus, Science Direct, Google Scholar, and Research Gate. Each database was searched using few terms; technological innovation, traditional musical instruments, augmented musical instruments, robotic, and preservation. Besides that, searching for relevant studies were also executed using reference list and citation from the database searches result.

In the process of selecting most relevant research for this study, initial search found many irrelevant studies. Besides using the research question to exclude the unnecessary studies, the problem statement was identifying just from the abstract, which is focused on the extinction, folk instruments, and the least interesting instruments in any field such as education, performance, and exhibition. After excluding those studies, there are few articles which were used in this study.

Among those existing studies used, not all articles were conducted in Nigeria even there limited study that discussed Nigeria traditional musical instruments. Most studies used were conducted Asia countries like Thailand, Indonesia, South Korea and China. These studies were selected based on three concepts of innovation which are: application tools with interactive interfaces, replicated instruments that do not use original instruments and those that use original instrument but with modifications.

Analysis and Discussion of Technological Innovation and Traditional Musical Instruments in Nigeria

A qualitative case study carried out among undergraduate students in Mahasarakham University Thailand by Phunsa (2014) applied augmented reality to promote traditional musical instruments on smart devices. The study showed positive responses toward promoting Thai cultural preservation, suitable video clips and sounds, creativity, attractive 3D models, and beautiful graphic display. Trangansri, et al., (2013) developed edutainment of online traditional musical 3D and evaluated the satisfaction of the edutainment. The study found that the overall quality of the system design was good and the degree of clarity was rated higher than target levels. Tan et al. (2018) developed augmented reality (AR) application by enriching digital musical instruments using technology to promote music education and traditional musical instruments to the young generation. The study showed that end-users, which are the primary school students and musical teachers, face difficulty scanning the maker due to inadequate light. The majority of the students agreed to use the application as starting to learn music education and derived entertainment from it. The system also presents an excellent environment for learning. Putra et al., (2019) designed controller Angklung using Arduino, Wi-Fi, and Android to promote Angklung as a traditional musical instrument. The design enabled traditional

musical instrument to communicate and change data through the internet, connect to a server and play music automatically. The attractive interface design was easy to understand by user. Permana et al., (2019) developed Augmented Reality based gamelan simulation with leap motion control and introduced how to play it by utilizing AR and Leap Motion among 5 smartphone users in Indonesia. There study found that there is need to have appropriate distance and brightness to get a better result. It was also discovered that technology can be an allurement for the users that never try or know gamelan before. Another study carried out by Ahmad (2012) investigate the user experience with Virtual Gamelan Mobile Application among 10 Smartphone users and 5 Gamelan musicians in Malaysia. The study revived and exposed gamelan to the public and preserved the traditional art form, and explored the use of the multi-touch capability of mobile device interface for playing gamelan. The study virtual gamelan mobile application was successfully emulated as a digital form for the mobile device market. Study also showed that it has better quality of sound and graphics.

The review above aimed to investigate and analyze studies on the exploration of using technology as part of Nigeria traditional musical instruments innovation. Almost all the articles state that the traditional musical instruments do not know by the public or almost extinct and changes need to be made to adapt the instrument in the modern world. Among the articles, three studies are used Augmented Reality technology (Phunsa, S., 2014; Permana, et al., 2019; Tan et al., 2018) where some of the results described the technology has parameters that need to be emphasized to get better outcomes which is the distance, height, angle and light surrounding. This could affect the innovation that aims to easy to use. Permana et al. (2019) described that the simulation has a lagging problem which might be because of the use of large resource files or disrupted WiFi connection. The article that using Virtual Reality technology for Thailand traditional musical instruments (Trangansari, et al., 2013) gives a positive outcome in the active learning system. However, the study does not describe in the article if there any limited number of audiences at one time entering the system and this was difficult to confirm whether the system reaches the goals as it is an online platform. Ahmad (2012) built a virtual application and state one of their aim is to preserve or revive the traditional instruments.

Conclusion

This paper discussed the design and methodology, public acceptance of the technological innovation used on the improvement of traditional musical instruments. According to the review, the best methodology to use for this innovation is virtual augmented reality where if the progress still goes on, it has chances to add or remove something based on advice from the expert and qualitative method to collect end-user respond when the instrument ready to play. Based on the findings, most studies proved that using such technologies can increase public interest toward traditional musical instruments. But it is found that the technological innovation of Nigeria traditional musical instruments is still less studied or less published to be a reference which might affect its value level in this modern world with a lot of western music that more popular.

Recommendations

The study therefore recommended that more technological innovation on Nigeria traditional musical instruments should do in the future to let it stay inline in this globalization era. Also researchers should try to concentrate on the less used concept and still promote the original traditions of the musical instruments which is the use of real instruments so that the modern world participants still can recognize the cultural heritage of Nigeria. Finally, to stay in line with modernization, further study might include other sounds that produce by the audience to give a better experience.

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