UNIVERSITY OF EDUCATION, WINNEBA

A DIGITAL PLATFORM FOR SOUNDS AND VISUALS OF *BƆBƆƆBƆ* INSTRUMENTS FOR MUSICAL ACTIVITIES

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DECLARATION

Candidate's Declaration

I, **Stephen Nyanteh Ayesu**, declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

Signature: …….

Date: …….

Supervisors' Declaration

We, hereby, declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of thesis as laid down by University of Education, Winneba.

Professor Obed Acquah Emmanuel (Principal Supervisor)

Signature: ……

Date: .....

Professor Cosmas Worlanyo Kofi Mereku (Co- Supervisor)

Signature: ……

Date: .....

DEDICATION

To Mr. Emmanuel Ayesu and Mrs. Charity Ayesu

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ABSTRACT

The relentless desire to use the sounds and visuals of Ghanaian traditional musical instruments on digital platforms can be seen in the effort to manipulate the sounds and visuals of Ghanaian traditional instruments for musical activities on digital platforms. The J.H. Nketiah's Digital Platform Model and other digital platform models embarked on holistic digitisation of the sounds and visuals of Ghanaian traditional music elements without making organized inferences to specific musical components such as musical instruments, songs and dance movements. Indeed, these models had no room to consider how stakeholders desired to use the sounds and visuals they created. Considering the importance of Ghanaian traditional musical instruments for various musical activities on digital platforms, *bɔbɔɔbɔ* was purposively selected for a traditional musical expedition. Based on the Uses and Gratification theory, the Interdisciplinary Theory and the Technological Acceptance Model, the study used bibliographic, discographic and applied ethnographic design to explore how stakeholders desired to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments. Based on the same theories, appropriate facility, equipment and specific techniques were then used to record the sounds and visuals of *bɔbɔɔbɔ* musical instruments to create a database and a template from WordPress was selected and edited to host the database to create the website for the sounds and visuals of *bɔbɔɔbɔ* musical instruments accordingly. The expedition resulted in a digital platform model termed the Two-Hand Steering Digital Platform Model for the sounds and visuals of Ghanaian traditional musical instruments. The study concluded that the idea to develop a digital platform for Ghanaian traditional musical elements should come from the viewpoints of the users and the practiceice should be guided by existing written and media materials as well as digital platforms. The study recommended the Two-hand Steering Digital Platform model for the development of digital platforms for elements in Ghanaian traditional music.

CHAPTER ONE

INTRODUCTION

1.0 Background of the Study

Digital platforms have changed social, commercial and educational activities in the world. Considering the rapid digitisation activities happening in Sub-Sahara Africa, it can be said that Africa has digitally emerged in social and economic activities. Michalke (2022) defines a digital platform as a building block that provides an essential function to a technological system and serves as a foundation upon which complementary products, technologies, or services can be developed. This implies that a digital platform is a structure that acts as a base for the creation of goods, innovations, or services. According to Gorenšek and Kohont (2019), digital platforms involve shifting an organisation from old approaches to new ways of working and thinking through the use of digital, social, mobile and emerging technologies. The drastic shift from traditional means of operation to recent digital platforms has informed various facets of commercial, educational and social activities. Similarly, Gray and Rumpe (2017) explain digital transformation as a buzzword that allows different stakeholders to inject various forms of innovation into their respective companies, businesses, governments, academic institutions, or other public services.

Creating a digital platform involves digitisation and digitalisation as recognized by Gorenšek and Kohont (2019). Digitisation is the encoding of analogue information into a digital format so that computers can store, process and transmit such information. (Verhoef et al., 2021). The act of converting analogue substances into digital formats is digitisation. It is, however, worth noting that the act of changing organisation processes

and tasks with digital technologies based on digitised data is digitalisation. In other words, the act of improving procedures for engaging materials or information with digital technologies and digitised data. Commenting on digitalization, Gorenšek and Kohont (2019) postulated that;

> Digitalisation is radically interfering with and changing the fundamental assumptions of the way of life and organisation of work in a postmodern society. The effectiveness of digital platforms in various spheres of contemporary society cannot be overstated, considering how various communities uphold digital technologies due to the credible results they achieve with digital platforms. The enormous space to save digital materials, easy and faster access, limitless space and time, easy creation of multiple copies and the ability to preserve information and materials for posterity are some of the benefits of digital platforms. (p.93)

The effectiveness of digital platforms in various sectors, institutions, entities and industries can be recognized in the form of digital libraries, databases, websites, digital archives, digital publications, digital educational packages, digital money and digital musical instruments. All these digital platforms have been developed to serve the dynamic needs of the global world.

Already, digital platforms are augmenting music education, music production, music performance and music composition in recognizable dimensions. There are various digital platforms and software applications for music education, production, performance and composition. Some of these digital platforms and software applications include Tonara - The Music Teacher App, Solfeg.io, Notion 6, MuseScore, Networked Music Performance (NMP) and Open Music Archive. Consequently, various digital platforms have been created for musical instruments for music

education, production, performance and composition on digital platforms. The Chinese, Indians, the West, Japanese and even some parts of northern Africa have digital platforms for their traditional musical instruments such as the ukulele, kora, mandolin, dizi, table, sitar, guzheng, koto, djembe. Examples of such digital platforms are imusic-school, SwarShala, Tarang and Virtual Koto. Sounds and visuals from these musical instruments have been digitised and digitalised in the form of websites, Play Store applications and other digital media handles for various musical activities. This has led to the unlimited assimilation of these traditional musical instruments in music education, composition, production, performance and research on digital platforms. Without a doubt, Ghana is endowed with a wealth of traditional musical instruments that can be digitized and digitalised to create a digital platform for musical activities. According to Selorm (2022), there are many instruments involved when it comes to Ghanaian traditional musical types. The sounds and visuals of traditional musical instruments of the Chinese, Indians, the West and the Japanese have dominated the digital platform for various musical activities. As an ethnomusicologist and a music technologist, the goal of this study was to change the current situation.

The power of digital platforms in enabling extensive assimilation of the sounds and visuals of traditional musical instruments into musical activities is probably the reason why so many cultures around the world have focused their attention on developing digital platforms for their traditional musical instruments. Should any unforeseen contingencies prevent students from using traditional musical instruments in the class lessons, or should music producers continue using Western musical instrument sounds in place of Ghanaian traditional musical instrument sounds on digital platforms for

production? Is it not about time for the sounds and visuals of Ghanaian traditional musical instruments to be established on digital platforms for musical activities and posterity?

It is worth stating that there have been incidences of digitisation activities at the Gramophone Library at the Ghana Broadcasting Corporation, the J.H Nketiah's Archive at the University of Ghana and the Department of Music Education, University of Education Winneba that aimed to establish a digital platform for sounds and visuals of Ghanaian traditional musical elements. However, the digital platforms created out of these projects did not create a technological structure where the sounds and visuals of Ghanaian traditional instruments such as the *vuga, dondo, gyile, gakogui* and *atumpan* could be engaged for music education, production, performance and composition. It is in this regard that the study sought to explore how the sounds and visuals of *bɔbɔɔbɔ* musical instruments can be digitised and digitalised to create a digital platform for musical activities. Just as sounds and visuals of traditional musical instruments around the world including the *sitar, kora* and the *jembe* are established on digital platforms such as websites, mobile applications, Play Store and other online handles, this study sought to create a digital platform (website) for the sounds and visuals of *bɔbɔɔbɔ* musical instruments.

1.1 Statement of the Problem

To create an effective digital platform for the sounds and visuals of Ghanaian traditional musical instruments which can be used for music education, production, performance

and composition, a model must be developed. Opoku-Boateng et al. (2020) described the processes used to convert the analogue sounds and visual recordings at J.H Nketia's Archive into digital format as a model for creating a digital platform for sounds and visuals of Ghanaian traditional musical elements. However, it is crucial to specifically create a model that systematically describes the methodology and techniques to create a digital platform for the sounds and visuals of Ghanaian traditional musical, as Nketia's model generally convert analogue recordings or records the sounds and visuals of various traditional musical elements primarily from ethnographic fieldwork into digital format. The absence of such a model has prevented the development of digital platforms that allow digital societies to use the sounds and visuals of Ghanaian traditional musical instruments for musical endeavours on digital platforms.

Additionally, it is difficult to predict how Ghanaian societies, which are receptive to a variety of digital technologies, will want the sounds and visuals of their traditional musical instruments on digital platforms. It is important to consider how members of the society wish to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments to serve as the basis for the creation of a digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments. This requires taking into account the different categories of musicians in digital societies and their relationship that connect *bɔbɔɔbɔ* musical instruments' sounds and visuals. For the most part, there has been no needs assessment for the development of digital platforms for the sounds and visuals of Ghanaian traditional musical elements. For instance, according to Opoku-Boateng et al. (2020), the digital platform developed at J.H. Nketiah's archive converted analogue sounds and visuals of Ghanaian traditional musical elements—primarily from J.H. Nketiah's field

research—into digital format without any exploration to identify the needs of the society. The systematic exploration of the differences or discrepancies between the desired situation or level of services ("what should be") and the actual situation or level of services ("what is") is what Karadeniz and Vatanartiran (2015) define as a needs assessment. The assimilation intention, which is primarily the reason for the creation of digital platforms, will not be achieved without an investigation to identify the dynamic usage of sounds and visuals of *bɔbɔɔbɔ* musical instruments and the dynamic desires to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms.

Moreover, finding a facility and equipment that can be used for recording, digitising and digitalising the sounds and visuals of traditional musical instruments is necessary for developing a digital platform for those sounds and visuals. It is crucial to digitize the sounds and visuals of *bɔbɔɔbɔ* musical instruments in a proper setting with the right recording and digitisation tools. J.H. Nketiah's archive and the gramophone library, according to Opoku-Boateng et al. (2020), were mostly recorded while conducting fieldwork using minimalistic recording equipment. To maintain the integrity of the sounds and visuals of traditional musical instruments on digital platforms, it is crucial to employ the appropriate facility and equipment rather than being minimal. This is necessary because, in the name of minimalism, utilizing inappropriate tools in inappropriate settings would alter the sounds and visuals of traditional musical instruments. For instance, recording and digitising the sound of the *vuga* drum, which produces lower frequencies, using the sound recording application on an Android smartphone will depict the *vuga* drum incorrectly. Similarly, using an inappropriate camera to take pictures or videos of *bɔbɔɔbɔ* musical instruments may cause the

perspectives to be distorted, misrepresenting the visual characteristics of *bɔbɔɔbɔ* musical instruments on digital platforms.

Furthermore, to meet the nature of societal needs, recording and digitising the sounds and visuals of traditional musical instruments requires certain procedures and approaches. It is crucial to use a careful and tried-and-true recording and digitisation procedure when recording and digitising traditional musical instruments because of the nature of their sound and visual representations. Mostly, ethnomusicologist or researcher in Ghana adopts the role of recording engineer, videographer, or photographer because they typically have a limited budget and lack the technical knowledge necessary for audio and visual recording and digitisation. The capacity to combine technicalities with the features of the sounds and visuals of Ghanaian traditional musical instruments is another conundrum to solve, even when the ethnomusicologist or the researcher possesses the technical abilities or employs a professional. To avoid sonic and visual misrepresentations of *bɔbɔɔbɔ* musical instruments on digital platforms, which could impede the intended assimilation expected, it is crucial to record and digitise by experimenting with different techniques reflexively.

Lastly, the effectiveness of digital platforms is diminished by the fact that the sounds and visuals of Ghanaian traditional musical instruments that have been recorded and converted to digital format sometimes wind up in places that prohibit simple and unfettered access. Only those who are physically present can access the digital platform created for Nketiah's Archive and the Gramophone Library. Similar to that, the

Department of Music Education at the University of Education, Winneba has created recorded and digitalised sounds and visuals on Ghanaian traditional musical elements, and they are only available in the department. This demonstrates the lack of digitalisation procedure for the sounds and visuals of Ghanaian traditional musical elements. The lack of a digitalised procedure for engaging the sounds and visuals of Ghanaian traditional musical instruments restricts access to the sounds and visuals of *bɔbɔɔbɔ* musical instruments, defeating the purpose of digital platforms by preventing members of the digital society who may not be close to the digitisation site from ever using these digital platforms. As a result of technological advancement, it is now possible to create websites, programs, virtual studio technology instruments and other digital platforms that can create an ongoing, limitless relationship with the sounds and visuals of *bɔbɔɔbɔ* musical instruments.

1.2 Purpose of the Study

The purpose of this study was to create a digital platform solely for the sounds and visuals of *bɔbɔɔbɔ* musical instruments within a regular Ghanaian technological setting for music education, production, performance and composition. The crux of this research was primarily on developing and creating an exclusive model and a digital platform for Ghanaian traditional musical instruments, taking into account digital platforms created for sounds and visuals of Ghanaian traditional musical elements. This digital platform would incorporate digital sounds, videos, and images of traditional musical instruments for musical activities on digital platforms.

1.3 Objectives of the Study

The study sought to:

1. develop a digital platform model for sounds and visuals of Ghanaian traditional musical instruments.
2. find out how a digital society wants to use sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms.
3. identify and describe appropriate facility and features of equipment to record and digitise the sounds and visuals of *bɔbɔɔbɔ* musical instruments.
4. digitise sounds and visuals of *bɔbɔɔbɔ* musical instruments with appropriate audio and visual techniques.
5. create a digital platform that enables the use of sounds and visuals of *bɔbɔɔbɔ* musical instruments in musical activities.

1.4 Research Questions

The study will be guided by the following research questions:

1. What digital platform model can be developed for sounds and visuals of Ghanaian traditional musical instruments?
2. How does a digital society want to use sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms?
3. What appropriate facility and features of equipment can be used to record and digitise the sounds and visuals of *bɔbɔɔbɔ* musical instruments?
4. In what way can sounds and visuals of *bɔbɔɔbɔ* musical instruments be digitised with appropriate audio and visual techniques?

5. What digital platform can be created for the use of sounds and visuals of *bɔbɔɔbɔ* musical instruments in musical activities?

1.5 Significance of the Study

The study suggests a novel approach that should be helpful to ethnomusicologists, music researchers and other scholars who want to create a digital platform for the sounds and visuals of Ghanaian traditional musical instruments. Through this study, the desire of a digital society to utilise the sounds and visuals of *bɔbɔɔbɔ* musical instruments for musical activities on digital platforms was brought to light. The Two-Hand Steering Digital Platform Model, a fresh model for creating a digital platform for Ghanaian traditional musical instruments, has been developed and it has given rise to new academic discussions and increased the rarity of digital platforms in ethnomusicological and music technical studies for Ghanaian traditional musical instruments.

Additionally, the developed digital platform would help teachers of music and students interact with images and videos of *bɔbɔɔbɔ* musical instruments on a digital platform for musical education. Also, the demands of musicians for tones and loops of *bɔbɔɔbɔ* musical instruments for music production and performance on digital platforms will be satisfied. Finally, the digital platform created is available to music composers who wish to use MIDI and staff notations of *bɔbɔɔbɔ* instrumental patterns for music compositions in music notation software programmes.

1.6 Delimitation

The project concentrated on creating a digital platform within the African context by utilizing the sounds and visuals of Ghanaian traditional musical instruments. The sounds and visuals of *bɔbɔɔbɔ* musical instruments used by the Eʋe in Ghana to perform *bɔbɔɔbɔ* traditional musical type were the focus of this study. It considered the needs of a digital society concerning the use of sounds and visuals of *bɔbɔɔbɔ* instruments on digital platforms. This study created a digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments for musical activities on digital platforms. To ensure the assimilation of the sounds and visuals of *bɔbɔɔbɔ* musical instruments into musical activities on digital platforms, the study used appropriate methods, facility and equipment to record, digitise and digitalise the sounds and visuals of *bɔbɔɔbɔ* musical instruments to serve the needs of a selected digital society.

1.7 Definition of terms

Due to the study's usage of technical terms, it is necessary to explain some terms to ensure a proper understanding of terms and concepts. The major terms used in this study are defined according to the following guidelines:

Digitisation

Digitisation is the converting of analogue sounds and visuals of traditional musical instruments into a digital format so that computers can store, process and transmit.

Digitalisation

Digitalisation is the process of modifying traditional procedures in engaging traditional musical instruments for musical activities using digital tools and digital data.

Digital Society

A society built on technological networks, information, and interaction facilitated by the internet is referred to as a "digital society."

Digital Platform

A digital platform is a technological stage or system that enables digitised products to be engaged and digitalised services to be provided.

Analogue Materials

Analogue materials are physical materials, such as books, manuscripts, photographs, videos, maps and mechanical audio or recordings on cassettes or tapes. Analogue equipment includes typewriters, tape recorders, photocopiers, cameras, and other tools used to create and store analogue documents.

Digital Materials

Digital materials are physical items that have been converted into digital formats for creation, storage, and transmission.

Stakeholders

The members of the digital society involved in or affected by digital platforms for Ghanaian traditional musical elements. They include musicians, music educators, music students, music producers, music performers, music composers, music researchers and ethnomusicologists.

Bɔbɔɔbɔ

Bɔbɔɔbɔ is the most popular recreational dance-drumming of the Eʋedomeawo, *Bɔbɔɔbɔ*, also known as *Agbeyeye* (New Life) and *Akpese* (Music of Joy), emerged from a village called Kpando in the Volta of Ghana during the independence struggle in the country between 1947 and 1957.

***Bɔbɔɔbɔ* Musical Instruments**

These are traditional musical instruments used in performing *bɔbɔɔbɔ* without the Western bugle.

BMU355

Ghanaian Traditional Music and Dance is a course in the Department of Music Education, University of Education, Winneba for the Bachelor of Art Music Students.

MUE119

Performance Practice in Ghanaian Traditional Music is a course in the Department of Music Education, University of Education, Winneba for the Bachelor of Art Music Education Students.

MUSG824

Computer Applications for Music Composition is a course in the Department of Music Education, University of Education, Winneba for the master of philosophy Students.

XML

eXtensible Markup Language. It is a versatile markup language used to store and transport data in a structured format.

U.E.W

University of Education, Winneba

1.8 Organisation of the Research Project

This study is in six chapters. Chapter one is the introduction and it involves the background of the study, the statement of the problem, the purpose of the study, objectives, research questions, significance of the study, delimitation and definition of terms. Chapter two involves a review of related literature, which includes the theoretical foundations for the study. Chapter three presents the methodology. While chapter four is the data presentation of the digitised sounds and visuals of *bɔbɔɔbɔ* instruments which served as the database for the digital platform. Chapter five is a presentation of the website and its operational instructions and finally, chapter six is the summary of the major findings of the research. This includes conclusions, recommendations and suggestions for further research. References and appendices follow chapter six.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Overview

This chapter is a review of the related studies, literature and initiatives for digital platforms for Ghanaian traditional musical elements. The innovation was stimulated by the aspiration to establish sounds and visuals of Ghanaian traditional musical instruments for music education, production, performance and composition on digital platforms. For this reason, the project was intended to create a digital platform for sounds and visuals of *bɔbɔɔbɔ* musical instruments. As already stated, there have been projects which created digital platforms for elements in Ghanaian traditional music such as the digitised Nketia's Archive, the Gramophone Library, the UEW Music Department digital platform and the Smithsonian Folkways Recordings. As a consequence, the review considered (a) Digital platforms in Ghana (b) Digital platforms for Ghanaian Traditional Musical Elements (c) Digital Platforms for Ghanaian Traditional Musical Instruments (d) Technological Innovations and Society's Demands and (e) Facility, Equipment and Techniques to Record Traditional Instruments. The review begins with discussions of the theoretical frameworks and a model that supported the study.

2.1 Theoretical Frameworks

According to Gregor (2006), the type of theory under development can influence the choice of an epistemological approach. This study was therefore underpinned by the Uses and Gratification Theory (Blumler & Katz, 1974) and the Interdisciplinary

Theory (Carp, 2018). Also, the Technology Acceptance Model (Davis, 1989) was adopted to mould the innovation.

2.1.1 Uses and Gratification Theory

According to Mehrad and Tajer (2016), the Uses and Gratification Theory adapts a functionalistic approach to communications and media and states that media's most important role is to fulfil the needs and motivations of the audience. Expressively, this theory hinges on the fact that audience use of media documents is driven by the purposes they fulfil. Certainly, this theory concentrates on how users seek media and to what extent they are satisfied with its type, content, and method of use (Amiri et al., 2012). Audience satisfaction has been the driving force behind the Uses and Gratification Theory. The Uses and Gratification Theory among other theories was chosen by the researcher to provide the theoretical bases to understand the gratification stakeholders demand from the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms. Quan-Haase (2012) revealed that the Uses and Gratification theory can help address critical research questions that emerge as individuals become further networked and embrace digital technologies for communication, information exchange, and content creation. Parveen (2017) also postulated that the uses and gratification theory roots itself in the idea that the people who "use" the media have certain 'gratifications' that they seek from it. Illustrating that people are always intentional with the kind of gratification they need from a media document. Parveen (2017) further revealed that since the gratifications sought may vary from one person to another, the way media will be used will also vary. Hence, operating with this theory established the need to reveal dynamic user perspectives with the right methodology in other to

consider appropriate facility, equipment and techniques for the recording, digitisation and digitalization of the sounds and visuals of *bɔbɔɔbɔ* instruments for a digital platform. Given that the Uses and Gratification theory has gone through phases of development as revealed by Mehrad and Tajer (2016), more propositions have been created, revised and merged and also fundamental steps have been taken toward the theoretical coherence of this approach. Mehrad and Tajer (2016) discussed the role Katz et al., (1974) and Katz, et al., (1973) played in describing the Uses and Gratification theory at its third phase of development. According to Mehrad and Tajer (2016), Katz et al. (1974) and Katz et al., (1973) corroborated and stated:

> Individuals are faced with their social and psychological needs and these needs create their expectations from mass media or other sources and ultimately lead to different patterns of media use or tendencies, the result of which is the gratification of needs. (p.4)

Upon this development, Rosengren (1974) developed a conceptual model for the Uses and Gratification theory.

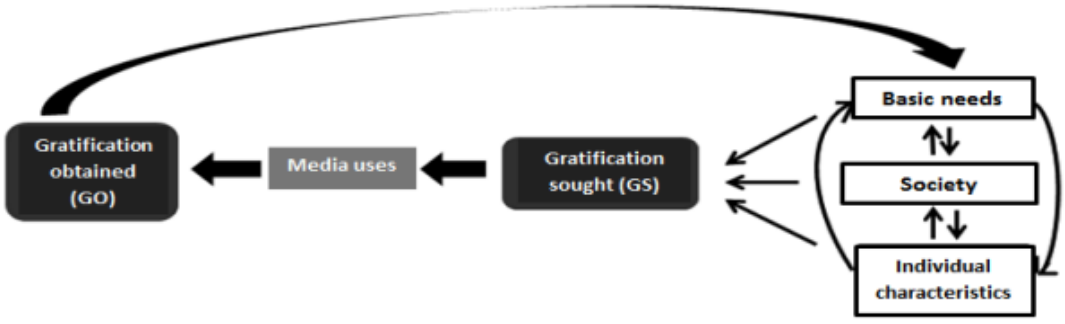


Figure 1: Rosengren (1974) Uses and Gratification

Accordingly, this model elucidated the Uses and Gratification theory as it describes the probing of basic needs, society and individual characteristics to determine the dynamics of media sought after to achieve gratification. As revealed by Katz et al., (1974) and

Katz et al., (1973), the interrelation between society, the basic needs of individuals and individual characteristics directs the kind of media documents needed. In essence, to adequately recognize how users seek sounds and visuals of *bɔbɔɔbɔ* instruments on digital platforms, these three factors had to be intertwined: basic needs, society, and individual characteristics. For this reason, the study, interacted with the natural society to understand the basic and dynamic needs in terms of sounds and visuals of *bɔbɔɔbɔ* musical instruments on a digital platform. The Uses and Gratification theory in effect triggered the interdisciplinary theory since the discoveries from the interactions revealed dynamic ways the digital society wanted to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments. Responding effectively to these needs entailed complications, which made it impossible for the researcher to be dogmatic about the music discipline alone in responding to the needs of the digital society. The interrelation of disciplines in music, sound engineering, visual arts, and ICT became eminent in the expedition to create the digital platform for sounds and visuals of *bɔbɔɔbɔ* instruments, hence the use of the interdisciplinary theory.

2.1.2 Interdisciplinary Theory

According to Klein (2010), the drivers of interdisciplinary growth and development have been the complexity of nature and society, the desire to explore problems and questions that do not nest comfortably within one discipline, the quest to solve society's problems, and the opportunity to exploit the power of new technologies. Notably, complications in societies and the natural principles of social interactions and connections initiated interdisciplinary theory. According to Newell (2001), the nature of complex systems provides a rationale for interdisciplinary principles. As exhibited

in the humanities, the interdisciplinary theory has been the foundation for the interrelation of disciplines for comprehensive understanding as well as resolving complex problems within languages or literature, the arts, history, and philosophy. As has been noted among several authorities across various disciplines, the environment and society's settings kindle problems that go beyond a single discipline for adequate appreciation and also introduce research questions that require interdisciplinary foundations to provide sufficient answers. Carp (2018) postulated that interdisciplinarity involves a synthesis or balance of multiple perspectives to produce such things as a deeper understanding or illumination, a balanced judgment, a viable solution, or a product that creatively accommodates the different perspectives. Given these points, Carp (2018) found the balance of multiple perspectives on three (3) pillars; illumination, balanced judgment, and viable solutions. The interdisciplinary theory provided the theoretical underpinning for the researcher to engage in activities to comprehend the dynamics of needs pertaining to the sounds and visuals of *bɔbɔɔbɔ* musical instruments from multiple perspectives. This theory allowed the use of bibliographic and discographic designs for balanced judgement about sounds and visuals of Ghanaian traditional musical elements, especially the musical instruments from multiple perspectives. In essence, this theory established the foundation to use the studio-based design to create a viable solution for the sounds and visuals of *bɔbɔɔbɔ* musical instruments from multiple perspectives in a reflexive manner. The study recognised and interrelated disciplines in music, sound engineering, visual arts and ICT to create a digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments. This made the researcher have the rightful judgement about the sounds and visuals of *bɔbɔɔbɔ* musical instruments. Basically, the study encroached on areas of study such as

audio engineering, photography, videography and content management systems in responding to the needs of the digital society. As postulated by Seeger (1986);

> The people from whose music we have developed our general theories about music-making are not always enthusiastic about the theories we have produced. We ourselves are not even happy with many of them today. But the descendants of the people upon whose recordings the theories were based would often like to obtain the original recordings for their own contemporary social and political uses. (p.266)

Seeger (1986) made this assertion to establish the consciousness needed to be deliberate in recording and creating platforms for traditional musical elements such as the sounds and visuals of Ghanaian traditional musical instruments. The researcher being conscious of the importance of sounds and visuals from ethnomusicology and other music research as well as the importance of being intentional with other disciplines also based the study on interdisciplinary theory (Carp, 2018). To respond to stakeholders' needs, the study became theoretically and technically complicated. As discussed above, the studies that aim to create solutions to society's problems mostly have an interdisciplinary theory as their fundamental support. Tzanetakis (2014) revealing the effectiveness of the interdisciplinary theory developed a technology to analyze sound recordings which were mostly done by trained scholars established the idea of computational ethnomusicology. According to Tzanetakis (2014) since the days of Charles Seeger, there have been many attempts to facilitate this analysis using various methods. Computational ethnomusicology came as the technological redeemer for the analysis of ethnomusicological recordings. Similarly, this study sought to remedies the lack of a digital platform for the sounds and visuals of Ghanaian traditional musical instruments. In order not to develop a digital platform that is theoretically justified but

practically feeble in terms of use, the study also fashioned the creation of the digital platform with the Technology Acceptance Model (Davis, 1986).

2.1.3 Technological Acceptance model

According to Schaetz et al. (2002), Model-based development relies on the use of explicit models to describe the development process including its activities and products. On this background, the Technology Acceptance Model (TAM) was adopted for this study. The Technology Acceptance Model (TAM), introduced by Davis (1986), is one of the most widely used models to explain user acceptance behaviour (Ma & Liu, 2005 p.60). Zaineldeen et al., (2020) defined TAM as a model that emulates how the customer comes to accept and utilise a technological innovation. The Technology Acceptance Model defines user acceptance behaviour towards any technological innovation or technological activity. Liao et al. (2018) explained that in an attempt to create a common theoretical basis for reasoned action, Davis (1986) developed the Technological Acceptance Model. Reasoning action operates on the assumption that people behave in a sensible and rational manner and their behaviour is based on the information available to them about a particular phenomenon. The technological acceptance model related these molds to proposes two external variables that moderate how people develop a particular behaviour towards technology, these are; Perceived Ease of Use and Perceived Usefulness.

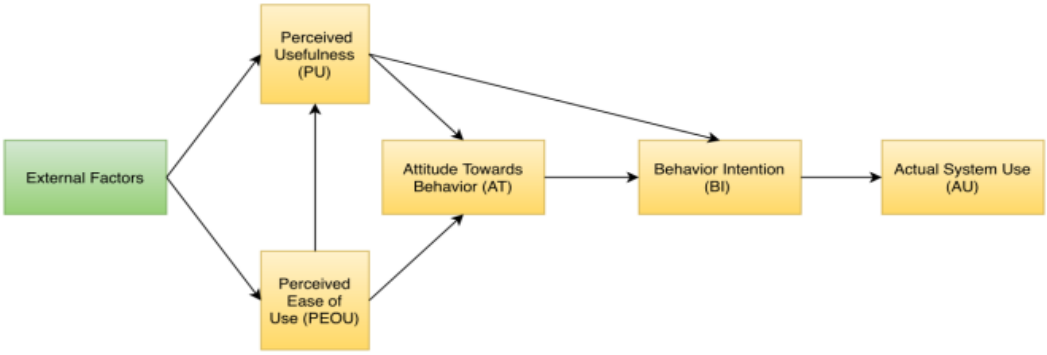


Figure 2: Technological Acceptance Model

According to Zaineldeen et al. (2020), Perceived Usefulness denotes the extent to which an individual accepts that employing a certain application framework will raise his or her work performance inside an organisation environment. Perceived Usefulness, therefore, is the user's subjective notion that employing a particular technology can enhance the quality of their work performance. It determines the degree to which a person accepts that utilizing a particular technology will improve his or her work effectiveness in society. Zaineldeen et al. (2020) further discussed Perceived Usefulness as the Subjective Norm which includes image, job relevance, output quality and results demonstrability.

- Image signifies the extent to which the user's status is perceived to be improved by the use of technology or the innovation in the user's social systems. The researcher considered how the use of the digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments will elevate the status of its users within the social system of musical activities. Consequently, the kind of image using the digital platform will create for a music educator who uses the digital platform to teach the playing of *bɔbɔɔbɔ* instruments was considered. This intent contributed to the selection of appropriate facility, equipment and appropriate

techniques to record, digitise and digitalise the sounds and visuals of *bɔbɔɔbɔ* musical instruments.

- Job relevance depicts the degree to which an innovation or technology is tied to a person's employment. The researcher carefully tied the creation of the digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments to the employment of people who use *bɔbɔɔbɔ* instruments for musical endeavours. For this reason, the researcher consciously configured the digital platform to the contemporary technological ramifications which consider the employee's capability in terms of technological innovations. As an example, a dance performer who may not use the digital platform may remain unemployed in a performance circumstance that demands dancers without instruments or drummers. This contributed to the selection of appropriate facility, equipment and appropriate techniques to create the digital platform of *bɔbɔɔbɔ* musical instruments.
- The output quality implies how much the new innovation or technology executes the work of the user. The researcher took into account how well the generated innovation performed the task for its users. For example, what will make a music producer choose the digital platform over the actual recording of *bɔbɔɔbɔ* instruments in a music production circumstance was considered. The researcher ensured that the facility, equipment and techniques used to create the digital platform of *bɔbɔɔbɔ* musical instruments produced a high-quality output that outwitted the regular music producer's effort to manipulate sounds in Virtual Studio Technology Instruments (VSTi) to serve as *bɔbɔɔbɔ* musical instruments sound for music production.

- Results demonstrability considers how distinct the visible results achieved with the technology or the innovation are. What makes the digital platform exceptional in terms of the visible results it can produce was considered. For instance, the researcher considered how a *vuga* variation score or MIDI file on the digital platform will be distinct from a regular music composer's effort to score this part in a music notation software programme. This consideration also made the researcher use the appropriate facility, equipment and techniques to record, digitise and digitalise the sounds and visuals of *bɔbɔɔbɔ* instruments.

Perceived Ease of Use on the other hand according to Zaineldeen et al. (2020) measures the level to which a person assumes that employing a system is effortless. The Perceived Ease of Use aspect of the TAM determines how much a person believes using a system is simple. Zaineldeen et al. (2020) discussed four anchors that influence Perceived Ease of Use, these are computer playfulness, perceptions of external control, computer self-efficacy, and computer anxiety.

- Computer playfulness signifies the essential encouragement to cooperate with new innovations or technology. In this case, the researcher employed as part of its creation of the digital platform mechanisms to motivate users to adopt the innovation. The researcher made use of audio and visual techniques as well as adopted some graphic design strategies that will entice users to visit and stay on the website for musical endeavours. For instance, the digital platform opens with a lively *bɔbɔɔbɔ* instrumental ensemble performance which will entice the user to explore its instrumental sounds and visuals.
- Perception of external controls involves the extent to which a person thinks that the technical and organisation resources are there to support the organisation

system they use. The researcher related to the research setting and involved the members of the digital society in the creation of the database and the digital platform (website) for the sounds and visuals of *bɔbɔɔbɔ* instruments. The creation of the database and the website was directly targeted at the activities of the members of the digital society therefore, the users had confidence that the digital platform was calibrated after their organisational system to support their work.

- Computer self-efficacy is the degree to which people think they can use a computer to complete a certain task. Again, the researcher considered the ability of the users to engage the digital platform on the computer. The researcher discovered that proficiency in using a computer to complete a task was commendable in the digital society. The researcher's respondents were members of the digital society and they already had proficiency in using the computer and its peripherals for musical activities. Therefore, situating the creation of the digital platform on the internet and computer technologies was not a challenge.
- Computer anxiety is a strong apprehension about using computers that is out of proportion to the threat that these devices pose. The researcher made the digital platform created user-friendly so that users with computer anxiety could easily engage the digital platform. The structure of the digital platform was simple, straightforward and devoid of ambiguity. For instance, the categories and sections for the sounds and visuals on the digital platform were calibrated based on how the respondents wanted them. Since the respondents represented the end users of the digital platform, their inputs were considered and the researcher used the appropriate techniques to ensure the prevention of computer anxiety.

The factors and anchors from Perceived Usefulness and Perceived Ease of Use respectively also directed the researcher to use the appropriate facility, equipment and techniques to create the database for the sounds and visuals of *bɔbɔɔbɔ* instruments. Also, these factors and anchors directed the use of the studio-based design to record, digitise and design the website. The factors and anchors from Perceived Usefulness and the Perceived Ease of Use ensured the development of a positive attitude towards using the website created for musical activities (Attitude Towards Behaviour). The Perceived Usefulness and the Attitude Towards Behaviour created a strong and justified intention for users to use the digital platform (website) created. The digital society for this study ended up using the digital platform for musical activities that involved the sounds and visuals of *bɔbɔɔbɔ* instruments on a digital platform (Actual System Use).

2.2 Digital Platforms in Ghana

It is important to review what digital platforms are and their effects on activities in Ghana to enable fruitful discussions in this section. Eijk et al. (2015) defined a digital platform as a (technological) basis for delivering or aggregating services/content from service/content providers to end-users. Similarly, Michalke (2022) defined a digital platform as a building block that provides an essential function to a technological system and serves as a foundation upon which complementary products, technologies or services can be developed. As can be seen, a digital platform can be described as a digital base made up of contents or products with a digital procedure that enables users to interact with digital information, products, innovations, or services. In other words, a digital platform involves digital content or services and digital procedures or ways of engagement for the ultimate end-user. As a matter of fact, Senyo et al. (2021) revealed

that, notwithstanding the digital divide, institutional voids, economic and development challenges facing less developed economies, digital platformisation as a strategy is fuelling technology leapfrogging in public sector transformation. Consistently, Gray and Rumpe (2017) explained digital platforms as a buzzword that allows different stakeholders to inject various forms of innovation into their respective companies, businesses, governments, academic institutions or other public services. Ghana as a country is considered to be developing, yet Ghanaians are incredibly active on digital platforms. Commenting on digital platforms in the Ghanaian agriculture system, Sarku et al. (2021) highlighted that digital platforms are available to smallholder farmers and agricultural extension agents, to analyze the public and or private governance arrangements that underpin the implementation of digital climate information delivery. Moreover, Preko et al. (2019) postulated that the Ghanaian health sector, as in many developing countries, seeks to continuously improve patient care through the use of various healthcare technologies. For the time being, the Ghanaian health insurance scheme which was previously renewed at health insurance offices now renewable on digital platforms. Ghanaians may avoid long queues and renew their health insurance with ease by using mobile devices. Agyapong (2020) as well commented on digital platforms and Ghana's financial sector and disclosed that digital platforms have revolutionised financial service provision and compelled financial services institutions to adopt technologies that help deliver quality service at a minimal cost. Also, Famiyeh and Twum-Barima (2011) discussed improved capacity utilisation, access to new technology, enhanced corporate social responsibility, diversification of strategy and extending firms' product lines as some benefits of ICT usage for banking. Examples of such developments include the popular mobile banking and E-zwich facility in Ghana. Likewise, Kotoua et al. (2015) revealed that education on digital platforms has brought

easy ways to study and get a degree to the doorsteps of the working classes and students alike in Ghana through higher educational institutions. Several educational institutions in Ghana are using online tools like Google Class, Moodles and other video conferencing services like Zoom and TeamViewer for both synchronous and asynchronous online education. In summary, the advent of digital platforms has undoubtedly revolutionized several activities in Ghana, and these activities have undoubtedly been accompanied by academic conversations with literature and publications that contribute to the advancement of digital platforms in these activities. On the contrary, Ghana has had several digital platforms for musical activities, but discussions about these platforms for Ghanaian traditional musical elements including songs, dance, drums, and costumes have not gotten enough attention. This study, therefore reviewed existing digital platforms for Ghanaian traditional musical elements and the possible models used in creating these digital platforms to develop a digital platform and a digital platform model for Ghanaian traditional musical instruments.

2.3 Digital Platforms for Ghanaian Traditional Musical Elements

Although there have been some digital platforms for Ghanaian traditional musical elements, relatively, few academics in Ghana have discussed these digital platforms. According to Shi (2021), with the advent of the information age, the Internet and digital media have turned out to be the main forms of music communication and play an important role in the communication and development of traditional music art. Likewise, Ayhan (2017) revealed that, with technological transformations as the first step of the information society, new communication technologies came into individuals' lives and started the digitalization process in many areas including

economic, social, and cultural products. The innovation of digital technologies has afforded the recording, digitisation and the creation of digital platforms for Ghanaian traditional musical elements for artistic and educational activities. For instance, Opoku-Boateng et al. (2020) discussed how J.H. Nketia's archive received funding from New York University's Moving Image and Archiving Programme (MIAP) to create a digital platform for the analogue recordings collected by J.H. Nketia and others for artistic and educational purposes. Correspondingly, Uehlin (2013), disclosed that the Norwegian Copyright Development OrganisationOrganisation, NORCODE, worked with numerous developing nations to help bolster their digital intellectual property assets through the process of creating digital platforms. Discussing the creation of digital platforms for Ghanaian music, Uehlin (2013) postulated that elements in traditional, gospel and highlife genres of music were digitised with the help of the Norwegian Copyright Development OrganisationOrganisation, NORCODE. Earlier, Markus Coester a German anthropologist and researcher secured funds from the German Government to digitize previously recorded musical elements that were in a deplorable state. This led to the creation of a digital platform for the Gram Library in Ghana Broadcasting Corporation (GBC) in 2006. Based on this background, there has been a series of activities to create digital platforms for the sounds and visuals of Ghanaian traditional musical elements including the songs, dance movements, drumming and costume. Notably, the Department of Music Education, University of Education Winneba has consistently engaged in using digital possibilities to create digital platforms for Ghanaian traditional musical elements for artistic and educational use. Opoku-Boateng et al. (2020) discussed the procedure used in creating the digital platform for J.H Nketia's Archive and crowned this procedure as a model for creating digital platforms for Ghanaian traditional musical elements. It is crucial to recognise

J.H. Nketia's digital platform creation model for Ghanaian traditional musical elements as described by Opoku-Boateng et al. (2020). This model prescribes the conversion of analogue records into digital format. Meanwhile, It is also important to recognise the procedure used at the Gram library which also converted analogue recordings of Ghanaian socio-cultural activities and Ghanaian traditional musical elements into digital format. Also, the Smithsonian Folkways Recordings converted analogue records of traditional music into digital format for digital platforms however an aspect of their activities as revealed by Elliott (2009) portrayed the recording of Ghanaian vocal and instrumental traditional music by professionals in the studio for musical activities on digital platforms. The most recent of the procedures which this study can attest to is the U.E.W music department model which digitally records Ghanaian traditional musical elements for music educational and artistic purposes. This study did not adopt any of these models because they did not focus on Ghanaian traditional musical instruments however, since these platforms were created in the Ghanaian socio-cultural context for music education and artistic purposes, it is important to analyse these models and the digital platforms created out of these models to serve as a foundation for new digital platform models or digital platforms. Indeed the scarcity of literature on this subject discourages such an expedition however, the few documents on J.H. Nketia, Gram Libray and the U.E.W Music Department digital platform models and the various digital platforms created for Ghanaian traditional musical elements can serve as starters for subsequent discourse. According to Pasman and Woodward (2003), often, the design and form of previous products constitute a basis for the generation of new ones. Although the existing models have been adopted by both scholars and digital media industries for more than three decades there has not been a review to consider the consistent developments in technological innovation which triggers consistent dynamic

demands and expectations on digital platforms. According to Lai (2017), reviews will help future scholars conceptualize, discern, and comprehend the underlying technology models and theories that may influence past, present, and future technological application adoption. Moreover, reviews will also provide some information about possible technological applications that can be created. Tarhini et al. (2013) also postulated that the critical evaluation of the previous theories and models would help future researchers in selecting appropriate single/multiple theoretical models/constructs for technological developments. Although few documents are commenting on the existing models for digital platforms, the results of these models can be seen on various digital platforms. The digital sounds and visuals of Ghanaian traditional musical elements on digital platforms at the J.H. Nketia's archive, the Gram Library, Smithsonian Folkways Recordings and the Music Department digital platforms and CDs are materials which qualify for review to serve as the basis for the creation of the digital platform for Ghanaian traditional musical instruments. This will serve as the background to develop a model for the creation of digital platforms for the sounds and visuals of *bɔbɔɔbɔ* musical instruments.

2.4 Digital Platforms for Ghanaian Traditional Musical Instruments

Durant (1990) commenting on the use of sounds and visuals of Ghanaian traditional musical instruments on digital platforms in the 1980s postulated that, the emergence of digital sampling, sequencing and other techniques which collectively redefined concepts and terminologies of music-making, introduced in effect a new kind of 'music literacy'. In the same way, Shriver (2003) testified to this music literacy in Malaysia and discussed how musicians and composers wanted to use Malaysian traditional

musical instruments and created a digital platform for Malaysian traditional musical instruments which involved a bank of digital samples of the indigenous instruments, for musicians and composers to use with conventional triggering devices such as keyboards, computers or drum triggers. In spite of the numerous opportunities presented by digital media technologies in developing countries like Ghana, the challenges are still eminent which prevent the country from tapping the full potential of digital media (Demuyakor, 2020). In Ghana, Acquah and Ayesu (2021) proposed the *Asanka* compositional model which prescribed the creation of a digital platform for the sounds of guitar-band highlife guitar patterns for computer-based composition on digital platforms. As Acquah and Ayesu (2021) and Shriver (2003) conceptually detailed methodological and technical processes for the creation of digital platforms for guitar patterns and Malaysian traditional musical instruments respectively, however, there has not been a digital platform in a similar manner for the sounds and visuals of Ghanaian traditional musical instruments. It has been demonstrated by Acquah and Ayesu (2021) and Shriver (2003) that the methodological and technical complexity that comes with developing effective digital platforms for traditional instruments demands the conceptualization of the process to afford credible results. Given that the nature of the sounds and visuals of musical instruments raise methodological and technical interrogations in the process of creating digital platforms for them, none of the existing digital platform models focused on Ghanaian traditional musical instruments in terms of methodology and technicalities. According to Arfib et al. (2003), Creating a digital platform for musical instruments is complex and some skills and methods can help the designer. Also, Roca-Puig et al. (2005) revealed that the development of new digital platforms for musical instruments is a broad field that covers areas highly technical as well as disciplines linked to the study of human behaviour. There is, therefore the need

to consider a digital platform creation model for the sounds and visuals of Ghanaian traditional musical instruments especially as technological development is constantly changing social-cultural activities. According to Evenson (2003), the rate and direction of technological innovation are viewed as induced by changes in relative resource endowments and by institutional innovations. Demuyakor (2020), postulated that since the introduction of digital technologies in the early 1990s, digital media and information and communication technology have shaped and continue to shape the media landscape of the good people of Ghana. Therefore, the resource endowment and the institutional innovation in Ghana as described by Durant (1990) involves the use of digital computers, digital synthesizers, digital samplers, drum machines, virtual musical instruments, computer-based educational visuals and compact discs for artistic and educational activities in Ghana. Stone and Stone (1981) revealed that the use of technological media is valuable, but the assumption of media objectivity is untenable. Therefore, to remain objective and avoid the temptation to assumptions, there is the need to consider a model to create a digital platform for Ghanaian traditional musical instruments based on the review of the existing digital platform models and the digital platforms created out of these models.

2.5 Technological Innovations and Society's Demands

Ghanaian societies are not oblivious to the competence of digital technologies to the extent that they cannot align their traditional instrumental needs to the possibilities that can be achieved on digital platforms. Therefore, it will not be necessary to discuss the legitimacy of individuals or groups in Ghanaian societies in coordinating their needs regarding the utilisation of Ghanaian traditional musical instruments on digital

platforms after taking into account the evidence of digital ramifications in various facets of Ghanaian societies. Instead, it will be more important to trust the digital society and base the creation of digital platforms for the sounds and visuals of Ghanaian traditional musical instruments on the needs of the societies. According to Pinch and Bijker (1984), both scientific facts and technological artefacts are to be understood as social constructs. Similarly, Bijker and D'Andrea (2009) revealed that technological responsibility is both a social and an individual assignment. As established by Pinch and Bijker (1984) as well as Bijker and d'Andrea (2009), technological innovations are deduced from conscious social concepts to address societal obligations. Gough (2020) also revealed that human needs are essential to buttress and give content to the concept of consumption corridors. Again, Ward and Lasen (2009) discussed that needs are known to be crucial behind much of the understanding of human behaviour. Society's demands, needs or wants play a dominant role in conceptualizing technological innovation. Creating a digital platform for Ghanaian traditional musical instruments for artistic and educational purposes therefore without the society's concept of demands will naturally forbid the artefact from the corridors of consumption. This implies that the only means of navigating the sounds and visuals of Ghanaian traditional musical instruments to the corridors of consumption is through the employment of appropriate methodologies that establish the society's concept of demands or needs. Considering the digital platforms created for the sounds and visuals of Ghanaian traditional musical elements, it is tempting to question the social problem that the platforms created are solving in terms of using sound and visuals of Ghanaian traditional musical elements on digital platforms for artistic and educational purposes since there have not been any discourse of the methodological procedures that afforded the details of the methodology and technicalities involved. To desist from methodological and technical doubts in

terms of solving the problems with the use of the sounds and visuals of Ghanaian traditional musical instruments on digital platforms for music education, production, performance and composition, there is the need to establish a credible methodology to organise how the Ghanaian societies want to use the sounds and visuals of Ghanaian traditional musical instruments on digital platforms. Zamaraeva et al. (2021) established that humanitarian knowledge is the most important resource in the formation of conceptual thinking as a basic component of intelligent development.

2.6 Facility, Equipment and Techniques to Record Traditional Instruments

Sincerely, academic discourse in Ghana around technical terms such as facility, equipment and techniques for recording is averagely low perhaps due to the dominant speciality of academicians in Ghana. Although few scholars in Ghana have ever bordered to discuss facilities, equipment and techniques for media recording in Ghana, it will be essential to acknowledge their opinions among other foreign opinions on facilities, equipment or techniques for recording to enable this review to be situated on contextual foundations. According to Rice (2014), musicians from every culture respond in one way or another to the animal and natural sounds of their environment. Therefore, Rice (2014) suggest that a cultural setting's acoustic dimensions correspond to the music-making exhibited in that society. Owusu-Poku (2021) also revealed that sound structure is a socio-cultural product constructed to suit a cultural group's philosophies and practices. Owusu-Poku (2021) further postulated that it is easy to agree that every society has its cultural perception of sound and its relation to music. This makes it clear that adhering to society's sonic and visual concepts is necessary while choosing a facility, equipment and recording techniques for the sounds and

visuals of Ghanaian traditional musical instruments. Owusu-Poku (2021) opined that, in Ghana's case, traditional, popular and art entertainment historically and socially perpetuates cultural perceptions of sound based on the way of life among the various ethnicities in the country. In this case, it can be accepted that the selection of facilities, equipment and techniques should be coordinated from the perspectives of the members of the cultural society. It is not surprising Owusu-Poku (2021) commenting on the selection of tools and techniques for Ghanaian highlife recording revealed that engineering techniques and tools employed in the recordings were socio-culturally influenced and constructed to resonate with the Ghanaian identity of the time. With that established, setting an obligation to create a digital platform for the sounds and visuals of Ghanaian traditional musical instruments definitely demands the selection of facility, equipment and tools from the perspectives of the members of the society. This may be the only means to socio-culturally represent the sonic and visual attributes of Ghanaian traditional musical instruments on digital platforms. Moreover, this approach may create the possibility of reflexivity which will enforce consistent verification of the appropriateness of the facility, equipment and techniques throughout the recording process. As postulated by Smolicki (2015), recording and archiving are generative and active processes requiring a reflective and critical approach to media technologies that they inherently rely on.

2.7 Conceptual Model for Ghanaian Traditional Instruments Digital Platform

A conceptual model for creating digital platforms for Ghanaian traditional musical instruments was gleaned from the review of theories and related literature and this may develop into a formal structure (framework) to direct ethnomusicologists or music

scholars who want to create digital platforms for Ghanaian traditional musical instruments.

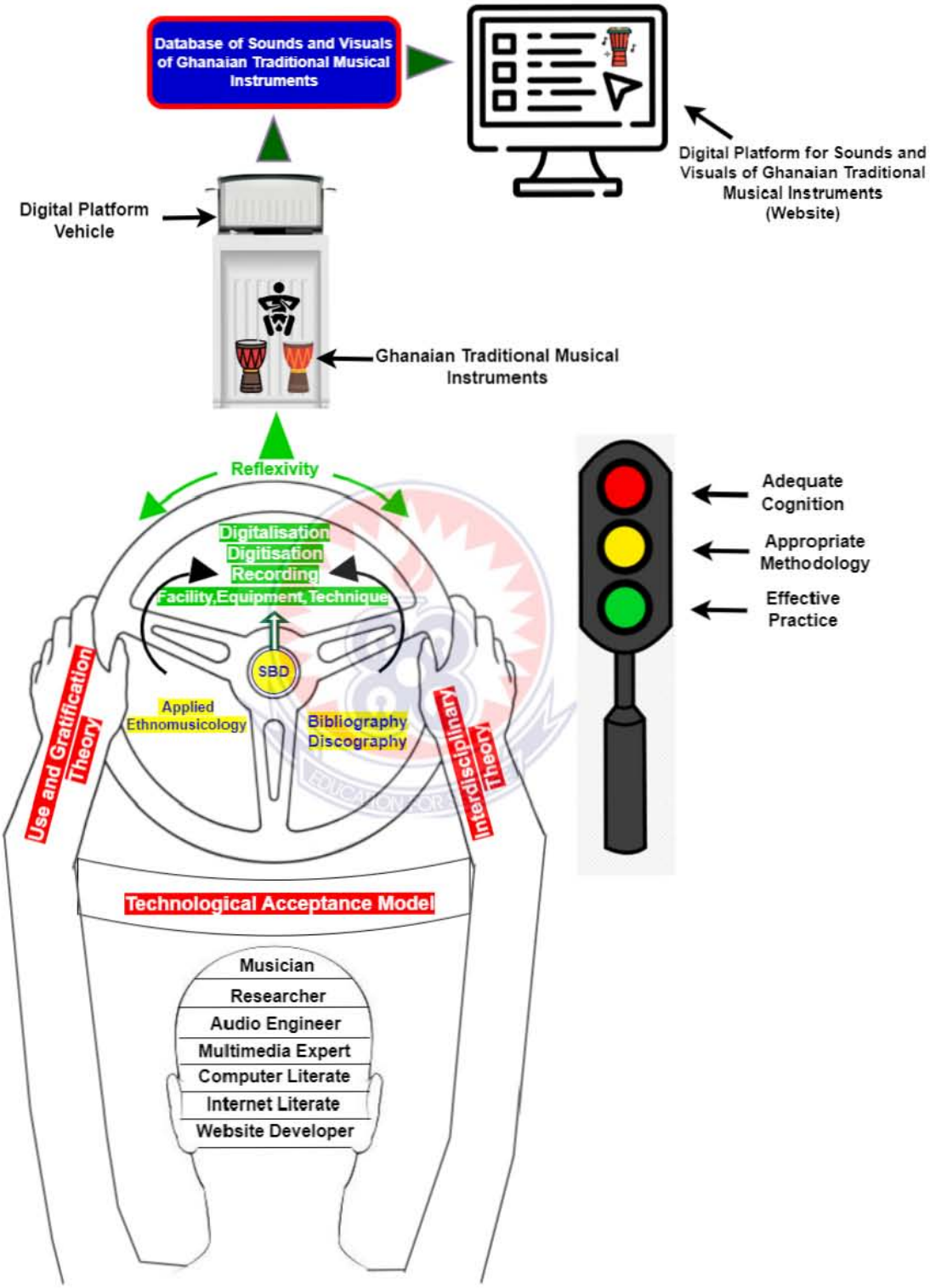


Figure 3: Two-Hand Steering Digital Model

Ghanaian traditional instrumental setup is the object to be transported to the digital platform. Traditional instrumental setups of the various traditional musical types in Ghana could be selected or individual Ghanaian traditional musical instruments could be selected. The destination for the vehicle is the digital platform, which can only be arrived at through adequate cognition, appropriate methodology and effective practice coordinated by a personality with multiple expertise. At the adequate cognition stage, a theory of use, interdisciplinary theory and a model that considers user acceptance behaviour to technology are needed. These theories should establish methodologies that allow an analysis of existing digital platforms, explore users' needs and employ practical designs for effective practice. Also, the selection of facility, equipment and techniques for the expedition should be gleaned from results gathered from the methodology employed. The final action to actually move the vehicle to the digital platform is the effective practice in a reflexive manner through the studio-based research design. This stage involves the recording of the sounds and visuals of the musical instruments, digital manipulation and the final digitisation (website development). Employing this model effectively will create a digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments.

CHAPTER THREE

METHODOLOGY

3.0 Overview

This section presents the processes and the research tools used in gathering the data for the study as well as the method used in creating the digital platform. It covers the research paradigm, research design, setting, population, sample and sampling techniques, data collection instruments, data collection procedures and the method of data analysis.

3.1 Research Paradigm

The study was conducted from the applied ethnomusicology point of view. Bridge (2008) is of the opinion that applied ethnomusicology is a problem-oriented study that is designed to bring about a desired change, the direction of which is guided by results from fieldwork. Such research produces better knowledge for better 'action'—that is, improved services, better education, or changes in policies. In fact, it is crucial for the creator of a digital platform to understand how the society wants to use the sounds and visuals of Ghanaian traditional musical instruments in order to have a background of their needs, which will form the basis for the development of the digital platform (Zamaraeva et al. 2021). This is because a digital platform must reflect the needs of a digital society. Because of this, the project was tackled by obtaining field data and applying the data to the development of the digital platform.

Basing on studies from other social sciences that use population-specific methodologies. I selected a qualitative research paradigm, which uses techniques that

result in a narrative, descriptive account of a setting or an activity. Denzin and Lincoln (2011) referred to qualitative research as interpretive, material practices that make the world visible. They added that these practices transform the world. Accordingly, the study gathered and/or processed text, images, or sounds. Moreover, Chen et al., (2019), discussing qualitative research and its practices revealed traditional narrative research, unstructured interviews and community-based participatory research to the more innovative critical incident and basic content analysis to those that used computer analysis to facilitate qualitative research as techniques in qualitative research. In order to improve practice through innovative practice, the qualitative paradigm thus permitted the study to assume an idiosyncratic position in its methodological structure. This allowed the amalgamation of different research designs within the qualitative research paradigm to resolve the research questions. Pragmatism in this case was integrated into the qualitative research paradigm. Pragmatism is based on the proposition that researchers should use the philosophical and/or methodological approach that works best for the particular research problem that is being investigated (Tashakkori & Teddlie, 1998). According to Simpson (2018), The word 'pragmatism' is commonly used in the English language to denote the practicalities of just getting on and doing what the situation demands. Pragmatism focuses on practical approaches and it implies being practical with the situation at hand and employing practical means to address the situation. Simpson (2018) further revealed that in the context of research, it has often been used to imply an anodyne alternative that might be adopted when there appears to be no clear paradigmatic preference to guide the process of inquiry.

3.2 Research Design

The study used bibliographic, discographic, applied ethnographic, studio-based and creative designs, which all fall within the qualitative research methodology. According to Acquah (2022) who propounded the bibliographic and discographic research design in music composition, bibliographic inquiry was conceptualized from the instructional approach used to enhance academic library in the educational process while discographic inquiry emanated from sources to describe the primary source materials for commercial recordings or log books prepared for recordings. Acquah (2022) made it clear that a bibliography involves using books and other written materials that have the appropriate sources of information as instructional materials for a study or the creation of an artefact. Discography on the other hand was revealed by Acquah (2022) as the design which enables the specific details of sound collections to be adhered to in the research. This study relied on the analysis of written documents and materials that commented on digital platforms and digital platform models for Ghanaian traditional musical elements as well as the analysis of audio and visual media on digital platforms. Acquah (2022) discussed the operationality of bibliographic and discographic design and revealed a framework for its utilization in music composition research:

> They can be used independently or complementarily in music composition research that deals with collection of sounds from scores and records for creating musical artefacts. It is a framework that comprises three phases: Phase one flows from data generation to establish the corpus necessary for musical creation. Phase two is the analysis of the corpus into parameters and components of the artefact to be created while phase three deals with the synthesis of the various parameters in the second phase using a design process to produce the musical work. The application of the bibliographic or discographic design can be combined with other designs such as the case study,

> creative ethnomusicology concept and other qualitative designs that may be significant as much as the necessities of particular inquiries in music composition are concerned. (p.11)

Consequently, this study employed both bibliography and discography. Furthermore, this study in a way adopted the framework proposed by Acquah (2022) by analyzing written, audio and visual documents on Ghanaian traditional musical elements to generate relevant information to record, digitise and finally create a website for the sounds and visuals of *bɔbɔɔbɔ* musical instruments. Written materials analysed involve "Renewing Cultural Resources and Sustaining J.H. Kwabena Nketia's Vision for an African Music Archive in Ghana" (Harper & Opoku-Boateng, 2019), "The J.H. Kwabena Nketia Archive at the University of Ghana- Legon" (Opoku-Boateng et al., 2020), "Asanka Compositional Model: An Aid to Computer Assisted Guitar-Band Highlife Music Composition with "Battery 4" Virtual Studio Technology Instrument" (Acquah & Ayesu, 2021), "Digitised Ghanaian Music: Empowering or Imperial?" (Uehlin, 2013) and "Opportunities and Challenges of Digital Media: A Comprehensive Literature Review of Ghana" (Demuyakor, 2020). Also, this design allowed the gathering of information from catalogues, digital audio and visuals that featured Ghanaian traditional musical elements. This included sounds and visuals of Ghanaian traditional musical elements at the J.H Nketiah's Archive, the Gramophone Library, Smithsonian Folk Ways Recordings and CDs of the Department of Music Education, University of Education, Winneba: Music Department Research Audios and Visuals (2017-2022), Lunch Time Concert Series (2019-2022) and African Unit (2017-2022).

Moreover, an applied ethnomusicology design was instituted in this study. According to Harrison et al. (2010), applied ethnomusicology is an approach guided by principles of social responsibility, which extends the usual academic goal of broadening and

deepening knowledge and understanding toward solving concrete problems and toward working both inside and beyond typical academic contexts. The study assumed the responsibility to understand and solve the problem of using sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms for musical activities. Similarly, Harrison (2016) commenting on applied ethnomusicology corroborated and stated:

> Applied ethnomusicology has acquired specific and internationally shared meanings and uses within a growing tendency, across the social sciences, arts and humanities, towards the societal usefulness of academic work. It is both distinct from and related to ethnomusicology in the public interest, public ethnomusicology, public sector ethnomusicology and engaged ethnomusicology. (p.1)

The link between applied ethnomusicology and ethnomusicology provided the comfort to adopt interviews in collecting information from participants. Standing on the idiosyncratic nature of the study, interviews were used to engage participants in solving the problem of assimilating the sounds and visuals of Ghanaian traditional musical instruments on digital platforms. Using this design, the researcher integrated with the members of the research setting to understand how they wanted to use sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms. The bibliographic design, discographic design and applied ethnomusicology respectively involved a collection of resources from literature, digital platforms and field work and also enabled the study to describe how digital societies wanted to use sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms. This featured publications and writings on digital platforms for Ghanaian traditional musical elements as well as existing digital platforms, digital audio and video CDs.

3.3 Creative Designs

The research was conducted in a stimulating environment, and as a result, it was more innovative and studio-based, creative designs were employed to create the digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments. Established on the Two-hand Steering Digital Platform Model, the creative design involved the organisation of the information that emerged from document analysis and data collected to steer the creation of the digital platform. This stage encompassed the use of bibliographic, discographic and interviews respectively to analyse existing digital platform models and digital platforms as well as reveal how society desires to use sounds and visuals of *bɔbɔɔbɔ* musical instruments of digital platforms. The next stage involved using the information collected to select appropriate facility, equipment and techniques for the recording, digitisation and digitalisation of the sounds and visuals of *bɔbɔɔbɔ* musical instruments. The aim was to create a digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments for musical endeavours on digital platforms. Therefore, the final stage of the creative design involves creating the digital platform through practice allowed by the studio-based design using the selected facitlity, equipment and techniques in a reflexive manner as well as describing the creation process in detail. At this stage, the sound and visuals of *bɔbɔɔbɔ* musical instruments were recorded and digitally manipulated to create a database as well as uploaded into a content management system to create a website for the sounds and visuals. Mumford et al, (2012) commented on the act of creating and stated that:

> Creative achievements are the basis for progress in our world. Although creative achievement is influenced by many variables, the basis for creativity is held to lie in the generation of high-quality, original, and elegant solutions to complex, novel, ill-defined problems. Creative problem-solving depends on the effective execution of a set of complex

> cognitive processes. Effective execution of these processes is, in turn, held to depend on the strategies employed in process execution and the knowledge being used in problem-solving. (p.30)

It is the effective execution of the set of complex cognitive processes that this design recognised.

3.4 Research Setting

The study took place in the Department of Music Education, University of Education Winneba. Majid (2018) postulated that the study setting is an important component of a research study. The nature, context, environment, and logistics of the study setting may influence how the research study is carried out. This study needed a clear description of the study's setting. The Department of Music Education is one of the most vibrant music institutions in West Africa. The department is one of the diploma institutions that train both professional musicians and music educators. Students in the department are trained in Western music, traditional music and popular musical types. Facilities in the department include dance studios, a piano laboratory, digital recording studios, a theatre, an orchestra room and a traditional instruments room. Among the music departments in Ghana, the Department of Music Education has become one of the leaders in the use of technology and the internet for musical training and activities. The Department has a new technology block with a music workstation laboratory, audio-visual centre, performance halls and a library. Also, the department with its keen interest in technology has competence in online music education through the use of the University Moodle and other online educational platforms like Google Classroom. Most importantly, the department possesses traditional musical instruments from the

various linguistic cultures in Ghana as well as the human personalities who train and perform traditional musical types such as *adowa, bɔbɔɔbɔ, kpanlogo, kete, gahu* and others. Surrounded by the technological infrastructure and digital platforms for musical endeavours, the study chose the Department of Music Education as the setting for this study.

3.5 Population

The population was made up of the digital societies in Ghana which use Ghanaian traditional musical instruments, traditional instrumental setups of Ghanaian traditional musical types and members of digital societies in Ghana that use traditional instrumental setups for musical endeavours. Casteel and Bridier (2021) postulated that population comprise individuals, dyads, groups, organisations, or other entities one seeks to understand and to whom or to which the study results may be generalized or transferred and is the principal group about which the research is concerned. The first set involved the digital societies in Ghana which use Ghanaian traditional musical instruments. As societies all over the world continue to base activities and operations on digital technologies, the interaction between digital technology and society has an overwhelming impact on musical instruments. Durant (1990) discussing digital societies and Ghanaian traditional musical instruments revealed that, the emergence of digital sampling, sequencing, and other techniques which collectively redefined concepts and terminologies of music-making in that decade, introduced in effect a new kind of 'music literacy'. The ethnically disseminated societies in Ghana enshrined with contemporary digital technologies which use computers, the internet, digital media, social media and others which use Ghanaian traditional musical instruments for various

activities form the first set of population for the study. These include societies such as the Department of Music Education, University of Education Winneba, Centre for Talent Expression, Winneba, University of Ghana Music Department, University of Cape Coast Music Department, KFM Music School, the National Center for Culture in Accra, Mido Music Production Limited, Reverb Studios and some churches in Ghana.

The second set of the population was traditional instrumental setups of Ghanaian traditional musical types. Younge (2011) revealed the musical traditions of Ghana's four main ethnic groups and comprehensively discussed the concepts of songs, dance and instrumental setups of twenty-two musical types or dance drumming ceremonies. The traditional instrumental setups of the various Ghanaian traditional musical types include *adowa, kete and sikyi from the Akans in Ghana, bɔbɔɔbɔ, gahu, agbadza and kenka* from the Ewes in Ghana and *kpanlogo* and *gome* from Ga's in Ghana. These traditional instrumental setups formed the second set of the population in this study.

Members of the digital societies in Ghana that use traditional musical instruments in their settings for various musical activities formed the third set of the population for this study. Such members include lecturers and teachers of Ghanaian traditional music, Ghanaian traditional dance performers, Ghanaian composers and producers who use elements of Ghanaian traditional instruments.

3.6 Sample

The study sampled five (5) members of the Department of Music Education, University of Education Winneba out of the members of the digital society. These members included an African Traditional music lecturer, a traditional music student, a music producer, a Ghanaian Traditional dance performer and a Professor of music composition. The African Traditional music lecturer is an expert in African Traditional music especially Ghanaian traditional musical types. He is a dancer and a drummer as well as an ethnomusicologist whose interest is in discovering facts about Ghanaian traditional musical types and also as part of his expedition he is normally involved in a field recording of elements of Ghanaian traditional musical types for music education purposes. A student of Ghanaian Traditional Music and Dance (BMU355) was also sampled. This student has consistently been part of the Ghanaian Traditional Music and Dance class which prepares the students to teach Ghanaian traditional music and dance as well as the African ensemble in the department for three (3) years. Similarly, a music producer who has produced several musical works for artists, popular bands, gospel bands, as well as the Ghana National Police bands, was selected as a sample for the study. This music producer has produced several songs for individual artists, choral groups and various musical bands in the Ghana Police Service. Some of these songs include Ghanaian Highlife variants, choral and recent afro beat styles that draw resources from Ghanaian traditional musical instruments. The Ghanaian Traditional dance performer has performed Ghanaian and other African dances in many parts of the African continent and some parts of Europe. He consistently performs at Departmental and University functions and ceremonies and has a huge repertoire of Ghanaian traditional dances. His dexterity in Ghanaian traditional dances has made him a top-notch dance performer and he is constantly engaged in solo performances in

dances such as *atsigbekor* and *adowa* as well as choreographic dance like *kpanlogo* and *bɔbɔɔbɔ*. He also assists in teaching Performance Practice in Ghanaian Traditional Music (MUE119) in the Department. The Professor of music composition is a celebrated Professor of Music Composition in the Department of Music Education who holds a PhD in Musical Composition from Leeds University, England and has a lot of compositions to his credit. This professor composed the University of Education, Winneba school anthem. In his graduate class, that is Computer Applications for Music Composition (MUSG824), he introduced students to compositions based on the creative ethnomusicology theory (Brukman, 2017) and interculturalism (Kimberlin and Euba, 1995).

3.7 Sampling Techniques

The researcher is a member of the Department of Music Education, University of Education Winneba community. The Department was conveniently selected as the setting for the study based on the accessibility, proximity and availability of the members of the Department. According to Etikan et al. (2016), convenience sampling is where members of the target population that meet certain practical criteria, such as easy accessibility, geographical proximity, availability at a given time, or the willingness to participate are included for the purpose of the study.

The study also used critical case purposive sampling to select *bɔbɔɔbɔ* traditional instrumental setups. According to Patton (2002), Critical case sampling can facilitate 'logical generalizations' with the reasoning 'that "if it happens there, it will happen

anywhere," or, vice versa, "if it doesn't happen there, it won't happen anywhere"'. To be able to form a general conclusion about the sounds and visuals of Ghanaian traditional musical instruments from a specific premise, critical case purposive sampling was used in this study. Also, Etikan et al. (2016), postulated that the purposive sampling technique, also called judgment sampling, is the deliberate choice of a participant due to the qualities the participant possesses. The researcher acknowledges the extent to which elements in *bɔbɔɔbɔ* musical type are used in various activities in Ghana. It is common to come across musicians performing *bɔbɔɔbɔ* rhythms for recreational activities. As a Ghanaian researcher, I have personally witnessed music teachers trying to teach music students how to play *bɔbɔɔbɔ* instruments. Also, I have consistently witnessed how *bɔbɔɔbɔ* instruments are used in societies and institutions for recreational, educational and religious activities. Elder (2009), described purposive sampling as the selection of units based on personal judgment rather than randomization. The researcher deemed *bɔbɔɔbɔ* instrumental setup as stunning and therefore worth sampling for this study. The five (5) members were also purposively selected with the critical case purposive sampling for the study due to their relevance in the department in terms of using sounds and visuals of *bɔbɔɔbɔ* instruments for musical endeavours.

3.8 Data Collection Instruments

The study used qualitative data collection techniques, including document analysis and interviews to understand and explain the social phenomena (Boamah et al., 2014). The former involved transcriptions from books, printed materials, digital platforms, audio and visual recordings of Ghanaian traditional musical elements. In order to confirm and

add to the information gathered from the books and materials regarding the sounds and visuals of Ghanaian traditional musical elements, listening was used as a complement to the data-gathering tools. The interview was used to collect information on how the sampled members of the Department of Music Education wanted to use sounds and visuals of *bɔbɔɔbɔ* instruments on digital platforms for musical endeavours

3.8.1 Document Analysis

It became necessary to utilise document analysis to detail information on sounds and visuals of Ghanaian traditional musical elements embedded in published books, videos, audio CDs and digital platforms. It sought to examine the sound and visuals of Ghanaian traditional musical elements which were important in the creation of the digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments. This instrument was used with the intention of revealing theoretical, methodological and practice deficiencies regarding models for elements in Ghanaian traditional music. Bridge (2008) characterized this as a problem-oriented study intended to effect the desired change.

3.8.2 Interview

The primary goal of the interview was to collect data on how respondents wanted to use sounds and visuals of Ghanaian traditional musical instruments on a digital platform. The interview was used to provide the opportunity for the respondents to contribute enormously to the study from their perspectives. Angrosino (2007) postulated that interviewing is the process of directing a conversation to collect information. The unstructured interview was used in this regard. Describing

unstructured interviews, Ryan et al. (2009) postulated that during the administration of an unstructured interview, the interviewer and the interviewee have a conversation about a specific topic in response to the interviewer asking broad, open-ended questions. Since the researcher was the interviewer, it was the researcher's responsibility to ensure that the interviewees were guided in responding to the open-ended questions in order not to limit information.

3.9 Data Collection Procedures

The study was started by explaining the purpose of the research to the Head of Department and seeking permission to collect data for this study. After seeking permission from the Head of Department, the researcher through his relationships with the participants explained what he was looking for to the participants and scheduled an appointment with them. The researcher conducted the interviews at the dance studio, the digital recording studio, the music performance hall and the music workstation laboratory on separate occasions. The researcher's open-ended question compelled the respondents to start the narration. The researcher listened as the respondent narrated how they wanted to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms without interjecting with further questioning. The researcher recorded the interviews as permission was sought from the participants. Afterward, the researcher asked further questions to provide clarity to some sections of the narrations by the respondents. The narrations were recorded in a notepad. Five separate narrations were collected from the five participants through writing. The tools used were a notepad, pen, audio recording application, laptop computer and a USB cable. The researcher recorded respondents' stories in the notepad for post-narration sessions. The

audio recording application was used as a digital voice recorder to capture the narrations of the participants to serve as a backup and verification avenue for the researcher's writings in the notepad. The audio recordings were transferred onto the laptop computer by using the USB cable to organise the recorded narrations.

Also, documents, materials, digital platforms, digital audio and visuals commenting and hosting digital platforms for sounds and visuals of Ghanaian traditional musical elements were explored from the J.H Nketia's digital Archive, the Gram Library, University of Ghana Music Department Library, the UEW Music Department library and the UEW Music Department African Unit digital media. These establishments are resourced with documents, materials, sounds and visuals on Ghanaian traditional musical elements. The Nketia's archive contains materials on sounds and visuals of Ghanaian traditional musical elements collected from 1980 to date. The Gram Library of the Ghana Broadcasting Corporation (G.B.C) also has records on sounds and visuals of Ghanaian traditional musical elements collected from the 1940s to date. University of Ghana Music Department Library possesses copies of published articles by scholars such as Harper and Opoku-Boateng (2019), Opoku-Boateng (2020), Adjetey (2015) and Sarpong (2004) which comment on the various digital platforms created for the sounds and visuals of Ghanaian traditional musical elements. Also, the sounds and visuals of Ghanaian traditional musical elements on digital platforms created by the J.H Nketia's archive, The Gram Library and the U.E.W Music Department African Unit were explored through listening, watching and analysing the audio and visuals. Through this exploration, the researcher collected information on the method and methodology employed in the creation of existing digital platforms for the sounds and visuals of

Ghanaian traditional musical elements. Information collected from this exploration was recorded in a notepad.

3.10 Method of Data Analysis

Narrative thematic analysis was applied to the data collected from the interviews. The narrations by the respondents on how they want to use sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms were analysed. According to Riessman (2002), narrative analysis in the human sciences refers to a family of approaches to diverse kinds of texts, which have in common a storied form. Riessman (2002) further revealed that narrative thematic analysis emphasises is on the content of a text, "what" is said more than "how" it is said, the "told" rather than the "telling". Focusing on the content of the text Butina (2015) postulated that the process of narrative thematic analysis consists of five (5) stages; (a) organisation and preparation of the data, (b) obtaining a general sense of the information, (c) the coding process, (d) categories or themes, and (e) interpretation of the data.

The first stage of the analysis was organised and prepared notes made during the interviews. According to Butina (2015), at this stage, any rudimentary pattern or themes can be noted in the margins of the transcripts. The notes from the five interview sections were appropriately compiled and rewritten, fundamental themes were indicated in the margins of the interview transcripts. The second stage involved obtaining a general sense of the information. In other words, the researcher familiarized himself with the narrations of the respondents. At this stage, the researcher read through the narratives

of the five respondents severally to maintain a general knowledge of how the information was organized. There was no need for a sophisticated coding mechanism or software programme as the researcher could easily identify ideas in the respondents' narrations, as well as sort and define these ideas. The key ideas recognised in the respondents' narrations from the five transcripts which described how they wanted to use sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms were written as the findings from the interviews.

3.11 Creating the Digital Platform for the Sounds and Visuals of *Bɔbɔɔbɔ* Instruments

Using the Two-Hand Steering Digital Platform Model, a cognition established on the Uses and Gratification Theory, Interdisciplinary Theory and Technological Acceptance Model propelled the researcher to gather information through bibliographic and discographic analysis. The information gathered informed the researcher of the deficiencies in existing models and digital platforms. The researcher then employed interviews to unearth how the research participants wanted to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms. The knowledge acquired from the bibliographic and discographic analysis as well as the interviews were used to select the audio-visual facility in the Department of Music Education, University of Education Winneba for the expedition as prescribed by the creative design. The same knowledge steered the selection of audio and visual equipment as well as audio and visual techniques for the recording, digitisation and digitalisation of the sounds and visuals of *bɔbɔɔbɔ* musical instrument. Again as demanded by the creative design, the studio-based research design was used reflexively to record and digitise the sounds and visuals

of *bɔbɔɔbɔ* musical instruments using the selected equipment and techniques. After the recording and digitisation, a database of sounds and visuals of *bɔbɔɔbɔ* musical instruments was created by exporting the digitised sounds and visuals into a folder on a computer. As directed by the creative design, a website template was selected from a content management system and through a reflexive manner, the researcher uploaded and labelled the sounds and visuals of *bɔbɔɔbɔ* musical instruments by creating categories for music education, production, performance and composition purposes. This process produced a digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments for music education, production, performance and composition on digital platforms.

CHAPTER FOUR

PRESENTATION OF DATA

THE CORPUS

4.0 Preamble

This chapter is the presentation of the data collected through bibliographic and discographic analysis and interviews as well as the database of sounds and visuals of *bɔbɔɔbɔ* musical instruments created through the creative design. Also, the facility, equipment and techniques selected for digitisation and digitalisation are presented in this section. The digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments is presented in the next chapter with a description of its components.

4.1 Results of Document Analysis

Both written materials about digital platforms for Ghanaian traditional musical elements as well as digital sounds, videos and images of Ghanaian traditional musical elements on digital platforms were analysed. The results from the analysis of the written materials are presented in this section. Concerning the written materials, the analysis focused on the theoretical, conceptual, methodological and practical actions recognised in the written materials which could contribute to the creation of the digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments. Concerning the digital sounds, videos and images of Ghanaian traditional musical elements the analysis focused on facilities, equipment and techniques which could be adopted to create digital platforms for the sounds and visuals of *bɔbɔɔbɔ* musical instruments.

4.1.1 Analysis of Written Documents

Demuyakor (2020) generally discussed the conceptualisation of digital technologies and digital platforms and presented opportunities, challenges and the way forward for the development of digital platforms based on the Convergence Culture theory. His submissions were consistent and projected contemporary digital possibilities within the entertainment industry such as the use of digital computers, digital media and internet technologies as innovations that can provide sounds and visuals on digital platforms for musical activities. According to Demuyakor (2020), sounds and visuals are obtainable on the internet which has been made possible by the exponential growth and demands of digital media. It is now very easy to upload and download sounds and visuals online via varied applications. This study acknowledged the concept of sounds and visuals being on digital and internet platforms and for that matter the possibility of uploading and downloading digital media for musical activities. This to some extent encouraged this study to consider creating a digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments for music education, production, performance and composition on digital platforms.

Also, analysing Uehlin (2013) gave a historical perspective to the expedition which was geared toward the creation of digital platforms for the sounds and visuals of *bɔbɔɔbɔ* musical instruments. It revealed the principles upon which the Center for World Music at the University of Hildesheim in Germany and the Ghana Broadcasting Corporation conceptualised the creation of a digital platform for the Gramophone Library. One of the foremost intentions in Ghana to create digital platforms was to digitise, archive and safeguard sounds and visuals of Ghanaian socio-cultural activities in which Ghanaian traditional musical elements formed a major part. According to Uehlin (2013),

traditional music has been a part of traditional Ghanaian society for time immemorial. Music is used to commemorate unions, meetings, and funerals alike. The persistent companionship between socio-cultural activities in Ghana and Ghanaian traditional music afforded the conception to digitise, archive and safeguard the sounds and visuals of Ghanaian traditional musical elements. This conception led to the digitisation of over 2000 CDs and 1000 audiocassettes of music at the Gramophone Library of the Ghana Broadcasting Corporation (Uehlin, 2013). This study recognised Ghanaian traditional musical instruments as integral parts of Ghanaian traditional music and therefore as objects to be considered in terms of creating digital platforms for Ghanaian traditional musical elements.

Again, by reviewing theories, Durant (1990) established the concept of creativity and technology. Durant (1990) reviewed the emergence of digital sampling, sequencing and other techniques which collectively redefined concepts and terminologies of music-making in that decade, introducing in effect a new kind of 'music literacy'. This study acknowledged the concept of creativity and technology and perceived the recording, digitisation and digitalisation of sounds and visuals of *bɔbɔɔbɔ* musical instruments based on the efficiency of digital sampling, digital sequencing and education on digital platforms. As part of stylistic changes which came with the concept of creativity and technology, Durant (1990) discussed digital sounds and visuals for musical activities in new circulating formats which affected the size, social characteristics and audience expectations. This study capitalised on the new circulating possibility to organise the sounds and visuals of *bɔbɔɔbɔ* musical instruments that can be circulated and integrated easily on digital platforms for musical activities.

Also, Harper and Opoku-Boateng (2019) examined the processes through which the J.H. Kwabena Nketia Archives has battled to build a sustainable model for audio-visual archiving within an African university and look to how its contents may serve future students and scholars to acknowledge African cultural materials and knowledge production in Africa. As revealed by Harper and Opoku-Boateng (2019) the Archives created by J.H. Kwabena Nketia have the intention to serve future students and scholars. The question then is how can current students, especially, those away from the site benefit from this establishment? Harper and Opoku-Boateng (2019) provided a valuable case study for how an African audio-visual archive is created and sustained however, admitted the challenges in accessibility. As insurance, this study considered the investments to establish the J.H. Kwabena Nketia Archives and how after all the investments, accessibility prevents current students and scholars who are not on site from interacting with the resources at the facility. In this regard, the study became intentional about the principles of digitalisation which established the bases to consider the use of a content management system to create a website for the sounds and visuals of *bɔbɔɔbɔ* musical instruments for artistic and educational purposes.

Moreover, Opoku-Boateng et al., (2020) made clear the interdisciplinarity of creating a digital platform for Ghanaian traditional musical elements. According to Opoku-Boateng et al. (2020), in the wake of creating a digital platform for the J.H. Nketia's Archive, the centre employed the services of an archivist, a research assistant who is also a database administrator, an audio digitisation technician, a video editor and a photographer. Opoku-Boateng et al. (2020) added that such varied expertise is a great advantage. This study makes the most out of the interdisciplinary theory from this idea.

The creation of the digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments was established also on the interdisciplinary theory since it enabled illumination, accurate judgement and the creation of viable solutions from multiple perspectives with varied expertise. However, in the case of this study, the researcher with expertise in audio engineering, visual editing, content management systems, internet technology, digital audio and digital visuals spearheaded the expedition and consistently sought advice from other professionals. Also, from this document, it was recognised that training the staff of the J.H. Nketia's Archive in creating digital platforms was to make the sounds and visuals available for education, scholarship and programming. Opoku-Boateng et al. (2020), postulated that, for the project, staff were trained to conserve, digitise and make accessible 400 hours of audiovisual heritage materials for teaching, scholarship and programming. As accessibility currently remains on site, it is fascinating to recognise that the digitised sounds and visuals are also intended to be adopted into audio and visual programming. This study also adopted the concept of educational and artistic use of the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms from this document.

Finally, Acquah and Ayesu (2021) established the compositional model for guitar-band highlife compositions on the concept of African Guitarism, creative ethnomusicology theory and the Websters model of creative thinking, and recommended the simulation of Ghanaian traditional sound patterns in BATTERY 4 VSTi from its natural setting for guitar-band highlife music creations. For this study, this concept showed the path to simulate the sounds and visuals of *bɔbɔɔbɔ* musical instruments into computer-based applications and digital devices for music education, production, performance and

composition. Moreover, the concept of generating the sounds and visuals from the natural setting was also taken from this document. In that sense, the practice to record, digitise and digitalise the sounds and the visuals of *bɔbɔɔbɔ* musical instruments to create a digital platform occurred in the natural setting of stakeholders who need the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms for musical activities.

The analysis of the written documents contributed to the preparation of a foundation for this study. Although the documents analysed did not directly provide theoretical, conceptual, methodological and practical guidelines in creating digital platforms for Ghanaian traditional musical instruments, the concepts adopted from these documents as listed in brief below contributed to the theorisation, conceptualisation, epistemological structure and practicalisation of this study. The concept adopted involves;

a) The possibility of sounds and visuals on digital and internet platforms in Ghana.
b) Ghanaian traditional musical elements can be organised on digital platforms for musical activities.
c) The possibility to merge creativity and digital technologies to organise sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms for musical activities.
d) The concept to be serious and intentional about making the sounds and visuals of *bɔbɔɔbɔ* musical instruments accessible worldwide through digitalisation due to the unkind trajectory of existing digital platforms.

e) The interdisciplinary concept of creating digital platforms for the sounds and visuals *bɔbɔɔbɔ* musical instruments for musical activities on digital platforms.

f) The idea of using sound and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms for education, scholarship and programming.

g) The concept of simulating sounds and visuals of *bɔbɔɔbɔ* musical instruments into computer-based applications and digital devices for musical activities.

h) The idea of generating the sounds and visuals of *bɔbɔɔbɔ* musical instruments from the natural setting of its users for the expedition.

4.1.2 Analysis of Audios and Visuals on the Digital Platforms

As a researcher with a multimedia background, listening and watching the audio and visuals as well as analysing some few descriptions of both the audio and visual recordings from the technical perspectives revealed methodological and practical facts that contributed to the creating the digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments. Watching and listening to the selected digital platforms and CDs revealed four circumstances for audio and visual recording and digitisation. The audio and visual recording and digitisation of Ghanaian traditional musical elements occurred under these four circumstances; (a) recordings during occasions such as festivals and funerals (b) recordings during concerts or recreational activities (c) recordings during programmes where Ghanaian traditional musical types serve as interludes (d) recordings staged by a researcher on the field. All these circumstances create an opportunity for the sounds and visuals of Ghanaian traditional musical

elements to be recorded and digitised. The analysis zoomed in on the method and techniques employed and how the media files were organised for educational and artistic use on digital platforms.

It is worthy of note that audio and visual records taken during occasions such as festivals and funerals were discovered and analysed. These kinds of audio and visual records were taken as the occasion unfolded with a series of events. Although Ghanaian traditional music plays a dominant role in such occasions, it was recognised that not all the events unfolding had musical significance. The recordings captured sequences of events, without special concentration on musical events. The recordings aimed at a holistic recording of the events during the occasion therefore, musical events became part of the storyboard but not as the main subject to cover. Some of these audio and visual records of Ghanaian traditional musical elements are found on the digital platform created at the Gramophone Library and the J.H. Nketia's Archive. These audio and visual records did not concentrate on capturing the musical events for music education and artistic purposes on digital platforms. However, stakeholders have developed the edge to recommend such records for activities in music education, production, performance and composition on digital platforms. This revelation from the analysis conscientised the researcher to be very objective in audio and visual recording in creating a digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments for music education, production, performance and composition on digital platforms.

Also, audio and visual records captured during concerts or recreational activities on various digital platforms were discovered and analysed. The analysis brought to bear

that Ghanaian traditional musical types performed at concerts and during recreational activities are instituted to serve the audience who participated or witnessed the performance. For that matter audio and visual recordings of such activities on the digital platforms concentrated on both the performance and audience actions. It was clear that the authors of such recordings did not consider these audios and visuals to be used for music education, production, performance and composition on digital platforms. Although these recordings are preserved for posterity, the audio and visual recording method was not methodologically and technically structured to be adopted for musical activities on digital platforms. Some of these audios and visuals are characterised by constant switches between performers and audience, holistic capturing of performers and frequent interjections from programme directors. These attributes make it impossible for a drum instructor to use such visuals on digital platforms for drumming lessons. A music producer cannot also rip sections of the audio for music production purposes because they a mostly a sonic composite of the entire performance with background noise. The analysis recognised that the Gramophone Library, the J.H. Nketia's Archive and the U.E.W Music Department had audios and visuals with these attributes. The development of the digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments was cautioned by this revelation.

Again, audio and visual records taken during programmes where Ghanaian traditional musical types served as interludes were discovered and analysed. The analysis revealed that records of Ghanaian traditional musical types performed at programmes such as university congregation, workshops and state programmes as interludes are not recorded by people who perceive the educational and artistic significance of these

performances on digital platforms. It was clear that since the traditional performances are not the focus of such programmes, they are treated as a subordinate objects of importance in terms of audio and visual recordings. The directors of these audio and visual records had no consideration for educational and artistic purposes on digital platforms therefore the method, techniques and recording structure annulled the significance of the recordings on the traditional performances for music education and artistic purposes. Such records were characterised by consistent switching of the camera between performances and special guests' reactions to the performance. Performances that had dancers separated from the drummers and singers were severe as a single camera is mostly used to capture these positions in irregular sequence or to capture the entire performance by using abnormal zooming out which makes sonic and visual subjects far and minor. These performance instances also do not use dedicated microphones with accurate frequency response but rather depend on the camera's microphone for the audio recordings. Considering such audio and visual records on digital platforms for drum lessons, music production, performance and composition will not amount to the desired results. The audio and visual analysis revealed that the Gramophone Library, the J.H. Nketia's Archive and the Music Department had such audio and visual content on digital platforms. Creating the digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments was informed by this discovery.

Finally, audio and visual records staged by a researcher on the field were discovered and analysed. These audio and visual records were taken mostly by researchers. The recordings by J.H. Nketia were recorded with two-track analogue tape recorders as part of his fieldwork to keep track of Ghanaian traditional musical activities (Opoku-

Boateng et al., 2020). Although J.H. Nketia's audio and visual recordings are yearned to be used on digital platforms for music education and artistic purposes, watching the recordings as a technical person, these recordings cannot be used to teach how to perform these traditional musical arts. Similarly listening to the audio on digital platforms, although digitised, it cannot be ripped into digital audio workstation's edit windows which require sounds recorded with precision and void of noise. J.H. Nketia was an ethnomusicologist who learned how to operate a two-track tape recorder and the analogue video camera for field recordings. As an ethnomusicologist, it was obvious that he lacked professional expertise in videography, photography and sound engineering. As a researcher with technical expertise in these areas listening and watching the audio and videos from this platform revealed technical flaws in sonic and visual perspectives, frequency spectrum, recording facility, tools, equipment employed and techniques employed during the recording. Although the recordings were staged, the noise as well as the sonic and visual imbalance portrayed the lack of technical expertise during the recordings. For instance, the sound of the fontomfrom drum which has its natural frequency residing within the lower register of frequencies sounded in the mid and high frequencies, devoid of actual low frequencies. The visuals reviewed mostly lacked natural visual perspectives. Camera positions and angles made smaller musical instruments appear relatively bigger and the orientations are at times displaced. Some videos do not even have sound components. Also, the Department of Music Education had records that have been staged and digitised on CDs. Some of these records just like the sounds and visuals found at J.H. Nketia's digital platform were staged by researchers with little expertise in multimedia and internet technologies. Audio and visual noise that obstruct the clear sounds and visuals of Ghanaian traditional musical elements were not controlled. Again, it was revealed that the sounds mostly

lacked adequate stereo perspectives. The sounds reviewed from these staged recordings on CDs and hosting centres such as J.H Nketia's digital platform, Gramophone Library digital platform and the Music Department's CDs mostly had misrepresented stereo images. Smithsonian Folkways Recordings, Rhythms of Life, Songs of Wisdom: Akan Music from Ghana recorded by Roger R. Vetter is made up of Ghanaian traditional music such as *adzewa, apatampa, fontonfrom.* The audios found on the digital platform mounted by the Smithsonian Folkways Recordings are made up of sounds of Ghanaian traditional musical instruments such as *Adawur ntaa* and *Afirikyiwa*. The recordings on the Smithsonian Folkways digital platform were created by technical experts such as Ghanaian cultural experts at the Central Region Office of the Ghanaian Centre for National Culture, Valerie Mau Vetter – Photographer, Roger Vetter - Photographer, Compiler, Liner Notes Editor, Recorder, Mastering Engineer, Visual Dialogue Designer, Recording Engineer and Field Worker. These recordings had clear and balanced audio and visual viewpoints. As a technical person, I can say the signal-to-noise ratio for the audio and visual was incredible. Meanwhile, all the technical aspects of the project were handled by Valerie Mau Vetter and Roger Vetter. The idea that a researcher can be technically equipped in multiple areas in multimedia, computer and internet technology was taken from the analysis of the audio and visuals on the Smithsonian Folkway digital platform. Roger Vetter was an ethnomusicologist and with his expertise in multiple fields in multimedia, he was able to create these recordings from both ethnomusicological and technical perspectives. Also, listening to the audio, it was obvious that the recordings were taken at an acoustically isolated place with professional equipment. The absolute eradication of noise and the balance between the musical instruments and the voices depict that the recordings were taken in a studio facility by a mixing and mastering engineer who used the appropriate techniques to

record and manipulate the sounds. Again the Smithsonian Folkway digital platform is hosted as a website for the global world to listen to and adopt the digital sounds of Ghanaian traditional musical elements for musical activities on digital platforms. Analysing the audios on the Smithsonian Folkways digital platform made the researcher explore appropriate facilities for the recording of the sounds and visuals of *bɔbɔɔbɔ* musical for the creation of the digital platform. Also, it led the researcher to explore the appropriate audio and visual techniques to record, digitise and manipulate the sounds and visuals of *bɔbɔɔbɔ* musical. Finally, the Smithsonian Folkway Recording website also encouraged the researcher to consider creating a website for the sounds and visuals of *bɔbɔɔbɔ* musical for them to be accessed on global platforms for music education, production, performance and composition.

Analyzing the sounds and visuals of Ghanaian traditional musical elements from the selected digital platforms and CDs provided the stage for this study to formulate profound objectives in creating a digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments. The concepts derived from analysis as listed in brief below contributed to the methodological, technical and practical structure for the creation of the digital platform. The concepts adopted involved;

a) Objective recording and digitisation.
b) Multiple scenes within a view
c) Stable focus
d) Relative zooming
e) Multiple expertise
f) Appropriate facilities

g) Appropriate equipment

h) Appropriate techniques

i) Website development for sounds and visuals

4.2 Results of the Interview

Five members of the Department of Music Education were selected for interview. These members were interviewed on how they want to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms. I assigned pseudonyms and codes to respondents to substitute the respondents' names for easy recognition and readability, these codes were selected according to the activities on the digital platforms they represented. Table 1 below shows respondents' codes and their assigned pseudonyms

Table 1:Interviewee Pseudonyms and Codes

Interviewee	Pseudonyms	Activities	Code
African Traditional Music Lecturer	Kwaw	Teaching *Bɔbɔɔbɔ* Drums	TBD
Traditional Music Student	Sikyi	Leaning *Bɔbɔɔbɔ* Drums	LBD
Music Producer	Dagomba	Music Production	MPR
Music Performer	Amponsah	Traditional Music Performance	TMP
Music Composer	Osoode	Music Composer	MC

4.2.1 Teaching Bɔbɔɔbɔ Drums (TBD)

The respondent was questioned during the interview to learn how he would want the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms to teach how to play *bɔbɔɔbɔ* musical instruments. The response from the respondent showed that most institutions worldwide interacted with digital platforms in some capacity to deliver practical drumming lessons in music. The response established that despite Ghana's poor internet infrastructure, numerous musical instrument lessons such as lessons in piano, drum set and saxophone are organized on digital platforms using videos, sounds, and visuals. Acknowledging the existence of videos, sounds and pictures on digital platforms such as CDs and computers in the department with elements of *bɔbɔɔbɔ* musical type, Kwaw revealed that those videos, audio and pictures cannot be used to teach how to play the instrumental patterns of *bɔbɔɔbɔ* musical instruments due to how they were created. Explaining why existing sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms and CDs cannot be used to teach how to play *bɔbɔɔbɔ* musical instruments, Kwaw said:

> *Sounds and Visuals to teach how to play bɔbɔɔbɔ musical instruments on digital platforms should be created with the purpose of teaching how to play the instruments. It shouldn't just be a video or audio recording of a performance by a bɔbɔɔbɔ ensemble. Instead, it should be developed to instruct students on how to play the bɔbɔɔbɔ drums. (TBD)*

Expressively, Kwaw described how he wanted to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments for *bɔbɔɔbɔ* drumming lessons on a digital platform. Kwaw made it clear that he wanted to teach his students through demonstrations using pictures and videos that demonstrated how to play every instrumental pattern in *bɔbɔɔbɔ* ensemble, including the master drum variations. He added that especially as the number of

students keeps on increasing and the number of musical instruments remains the same, one-on-one interaction with students is very difficult for myself and the supporting staff. Kwaw insisted on the fact that there are a lot of Western drum kit lessons organized on website platforms such as Coursera, Udemy and Class Central for the sole purpose of teaching how to play the drums. Expanding on how he wanted to use the sound and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms, Kwaw said:

> *I want clear pictures of the musical instruments as well as organized video lessons on playing bɔbɔɔbɔ instrumental patterns prepared in slow and moderate tempos. I want pictures that demonstrate how the musical instruments are held as well as pictures that adequately show the images of the musical instruments from multiple perspectives for adequate appreciation. I want my students you interact with these pictures and videos of bɔbɔɔbɔ drumming before my face-to-face sessions with them. If there is a website for such sounds and visuals I will then send the website links to my students for them to learn. (TBD)*

With this in mind, Kwaw made it known that he is adamant that his students can quickly pick up playing the instrumental patterns of *bɔbɔɔbɔ* from online video platforms because they are already learning how to play other instruments via online video platforms. Then he added that meeting them face-to-face within the limited time and with the limited musical instruments will just be an overview and recap of lessons learnt on online video platforms. Expressively, Kwaw further described how beneficial such a digital video platform would be to him. Kwaw disclosed that he would not waste time teaching the students everything from scratch, rather he would focus on the challenging parts of the drumming lessons. Kwaw further added since traditional musical instruments are always available in the instruments room, students can access them at their convenience and with the help of online videos, they can learn the instrumental patterns. For the most part, Kwaw insisted that apart from giving students links to

sounds and visuals, there should be the possibility for students to download these sounds and visuals of *bɔbɔɔbɔ* instrument drumming from online platforms to secure students against unstable internet connectivity. Finally remembering the recent Covid-19 lockdown which prevented face-to-face lessons, Kwaw said:

> *Using Zoom and Microsoft Meet, I was able to teach my students how to sing bɔbɔɔbɔ ensemble songs, dance, and costume, but I was unable to do the same for bɔbɔɔbɔ drumming lessons because I lacked the knowledge of using the equipment, techniques and the various expertise to create sounds and visuals for the bɔbɔɔbɔ musical instruments for online drum lessons. (TBD)*

Kwaw essentially needed a short sequence of digitally recorded drum lessons on *bɔbɔɔbɔ* instrumentation that are available on a website and follow the proper pedagogical structure in drumming lessons. Kwaw merely wants to provide his students links to short videos of how to play *bɔbɔɔbɔ* instrumental patterns on websites so that they can learn at their own pace without restrictions of location and time. He specifically made it known that he did not want the other elements in *bɔbɔɔbɔ* ensemble such as dance movement and songs to interfere with the drum lessons therefore he disregarded the existing videos on *bɔbɔɔbɔ* on ensembles for the drum lessons. Moreover, he revealed that videos on how to play *bɔbɔɔbɔ* instrumental patterns should capture the details of body position and hand relation with the musical instruments. Reflecting on existing videos on *bɔbɔɔbɔ* musical elements, Kwaw expressed how he wanted the videos to be oriented and said:

> *Videos on Ghanaian traditional musical elements do not focus on the sections that could be beneficial for drum lessons. Even if they did, the body and hand postures are normally not in focus. (TBD)*

The closing remarks made by Kwaw indicated that he had drumming students who were not close to him and for that matter, he had to travel to engage them during *bɔbɔɔbɔ* drumming lessons. He said;

> *If a website for bɔbɔɔbɔ drumming lessons is available with the right pedagogical structures, I will reduce my face-to-face contact hours with distant students and increase my online sessions with them. (TBD)*

Apart from these distant students, Kwaw made it known that he is normally contracted to come and teach how to play *bɔbɔɔbɔ* musical instruments by groups who normally know the dance moves and the songs. Therefore a digital platform in this vein will increase the number of clients he can engage within a limited time. Kwaw frankly said this will definitely increase his income as a *bɔbɔɔbɔ* drumming instructor and he believes very soon the modalities of teaching students how to play the traditional drums will follow such teaching coordination.

4.2.2 Learning Bɔbɔɔbɔ Drums (LBD)

The respondent was engaged on how he wanted *bɔbɔɔbɔ* drum lessons on digital platforms. Sikyi revealed that most students in music institutions all around the world can interact with digital platforms for practical music lessons. He postulated that despite Ghana's issues with internet connectivity, many music lessons such as keyboard skills and Western drum sets are organized on digital platforms and a lot of students including himself have learned how to play musical instruments through digital platforms watching and imitating teachers through sound and visual materials. Sikyi further revealed that because the music programmes in the department are very robust with a

lot of theory and practical courses, it is easy to forget traditional drumming lessons without consistent practice. He disclosed that since it is rare to possess traditional musical instruments for personal practice, videos on how to play *bɔbɔɔbɔ* musical instruments should be serialized on digital platforms for students to watch, imitate and practice. Also, Sikyi admitted that there are some digital platforms and CDs that contain elements of *bɔbɔɔbɔ* musical ensemble however, these audio and visual materials do not distinguish the various instrumental patterns for easy learning. Sikyi said:

> *I do not want to be confused by watching already existing videos online to learn how to play bɔbɔɔbɔ instrumental patterns because of the way they are created and organized. I want to concentrate on individual instrumental patterns and when I have grasped it then I can perform it with the other instruments in the traditional ensemble. (LBD)*

Although the interview sessions for Kwaw and Sikyi were on separate occasions, they all did not support the idea of using an ensemble kind of performance to teach or learn how to play *bɔbɔɔbɔ* musical instruments. Describing how he wanted sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms, Sikyi said:

> *As a student learning a lot of traditional instrumental patterns, I wish I could have a short digital audio-visual platform that teaches how to play bɔbɔɔbɔ musical instruments. I want the sounds and visuals to be in slow and medium tempos to enable me to easily grasp the instrumental patterns. The master drum (vuga) especially employs a lot of playing techniques therefore I want the media file of the master drum variations to be broken down into several parts for me to easily grasp its complex rhythms. (LBD)*

Sikyi revealed that he wants to use his Android mobile device to easily access audio-visual lessons on how to play *bɔbɔɔbɔ* instruments so that he can easily learn the instrumental patterns without the presence of his drum instructor. Sikyi recounted the

difficulties in remembering all the instrumental parts during examinations since they did not have personal *bɔbɔɔbɔ* instruments for rehearsals like keyboards and guitars. Sikyi insisted that the sounds and visuals of *bɔbɔɔbɔ* musical instruments should be systematically configured without obstructions from the other *bɔbɔɔbɔ* musical elements so that without the teacher or the instructor, he can easily learn from his mobile device how to play the instrumental parts. Moreover, Sakyi made it known that he wanted the sounds and visuals of *bɔbɔɔbɔ* musical instruments like a student companion which can be accessed anytime and everywhere. Therefore he wanted a website where he could access the sounds and visuals of *bɔbɔɔbɔ* musical instruments both online and offline. He said:

> *During examinations, I have to recollect how to play the instrumental patterns of two–three different Ghanaian traditional instrumental setups including the bɔbɔɔbɔ musical instruments. It is most difficult to recall and perform all these individual instrumental patterns in one examination sitting. Therefore, having the sounds and visuals of bɔbɔɔbɔ musical instruments both online and offline like a student companion will aid my memory and recollection at any time and anywhere. (LBD)*

Lastly, Sakyi disclosed that because he is a music education student and he will be teaching in either a senior high school or a junior high school in Ghana after his four-year Bachelor of Arts Music Education Programme, he wants to download and play the sounds and visuals of *bɔbɔɔbɔ* musical instruments to his students as part of his teaching and learning materials to aid easy teaching. Therefore he also wanted the sounds and visuals of *bɔbɔɔbɔ* musical instruments to be downloadable.

4.2.3 Music Production (IPR)

The respondent indicated the importance that traditional musical instruments from around the world have in music production. He mentioned the kora as a traditional African instrument that has gained popularity in the music production industry recognizing the several Virtual Studio Technology instrument versions created with the sounds and visuals of the kora. Recognizing the difficulties in using sounds from *bɔbɔɔbɔ* musical instruments in music production, Dagomba revealed that since his studio is a project studio with few input transducers, the most reliable way he wants to use sounds of *bɔbɔɔbɔ* musical instrument is to engage a digital library made up the tones and loops of the instrumental patterns. Dagomba revealed how he desired sounds of *bɔbɔɔbɔ* musical instruments for music production and stated that:

> *I have more than ten years of experience producing music for numerous bands, choral groups, and artists in Ghana and other countries. Artists, ensembles and I have often wanted to use the natural sounds of bɔbɔɔbɔ musical instruments in popular, choral, and gospel music in my studio. I have always longed for a digital platform where I could download and import loops and varieties of tones of individual bɔbɔɔbɔ musical instruments as well as the complete instrumental ensemble sounds into DAWs for music production purposes. (MPR)*

Disclosing the fact that digital audio workstations allow the importation of digital audio into edit windows of digital audio and provide time-stretching possibilities, Dagomba expressed that he wanted to import loops of *bɔbɔɔbɔ* musical instruments into edit windows of digital audio workstations. He also said he wanted to use tones of *bɔbɔɔbɔ* musical instruments in VSTi's such as Battery 4 and Kontakt to trigger these sounds with MIDI configurations. He further clarified that, using a MIDI controller he can then

trigger the VSTi which will be hosting the tones of the *bɔbɔɔbɔ* musical instruments to create instrumental patterns for music production purposes. Dagomba said:

> *If there are digital platforms for sounds of bɔbɔɔbɔ musical instruments for music production purposes, I do not need to worry about recording sounds of bɔbɔɔbɔ musical instruments for music production since my studio lacks the necessary acoustic space or equipment for professional sound recording. I want to import the loops and tones from websites into my DAW and VSTi for my music production activities. (MPR)*

The interview, therefore, revealed that Dagomba wants to import tones and loops of *bɔbɔɔbɔ* musical instruments into VSTi's and DAWs for music production purposes. Dagomba made it clear that until there is a digital platform where he can download tones and loops for productions that demand traditional sounds of *bɔbɔɔbɔ* musical instruments, he will continue to depend on the manipulation of the Western sound libraries although they do not satisfy his artistic needs as well as his clients' artistic needs. Dagomba said:

> *I am forced to manipulate Western sound libraries because I do not get any website containing the tones and loops of traditional bɔbɔɔbɔ musical instruments that have been digitised with the proper tools and techniques. Even though there are some digitised sounds available online, I am unable to use any of them since they were poorly recorded. (MPR)*

The respondent insisted at the end of the interview that the real sounds of Ghanaian traditional musical instruments would not be on global digital music production platforms unless stakeholders make a conscious effort to properly record and develop a website for these sounds.

4.2.4 Traditional Music Performance (TMP)

The interviewee emphasized that while *bɔbɔɔbɔ* performances include singers, dancers, drummers, and costumes, most of the time these elements can be manipulated due to performance circumstances, group organisation and the clients' budgets. Amponsah said:

> *There are times when performance circumstances, group organisation and client's budget limit the number of performers because of financial restrictions or constrained performance space. This has made me reduce the number of performers affecting my drummers several times. Also, some of my drummers have severely disappointed me during programmes. Because of these experiences, I want to have backup sound loops of the bɔbɔɔbɔ instrumental patterns on my laptop for emergency cases. (TMP)*

Amponsah lamented how a cherished client specifically requested for *bɔbɔɔbɔ* ensemble and almost all his drummers disappointed him. He said since then he started thinking of a means to perform even without the drummers or singers around. Additionally, Amponsah indicated that he wants the individual sound loops of the *bɔbɔɔbɔ* musical instruments as well as the sound loop of the entire instruments for both group and individual rehearsals. Amponsah said:

> *I want to use the bɔbɔɔbɔ drum instrumental loops for personal rehearsals. To avoid repeating the same dance routine, I normally create new choreography for my bɔbɔɔbɔ ensemble performances as a bɔbɔɔbɔ dancer, because of this I plan rehearsals with my fellow dancers frequently. Since the drummers frequently disappoint me, I have been looking for a mobile application or website for authentic bɔbɔɔbɔ musical instrumentation in a regular tempo for rehearsals. (TMP)*

Amponsah believes that if he gets a digital platform that can provide authentic instrumental loops of *bɔbɔɔbɔ* musical instruments he would not be bothered by the conduct of his drummers and also he would get more clients to perform for. He strongly believes using the Ableton Live software programme he can upload the tones and loops and dance along with his dancers without the drummers. Amponsah explained how he is going to get more clients:

> *I will simply take contracts and perform without the burden of worrying about disappointing drummers with a small number of dancers. I can still picture one Christmas Eve when a client requested for bɔbɔɔbɔ ensemble to welcome a diplomat at the Kotoka International Airport. The client revealed that the diplomat had seen bɔbɔɔbɔ performed before and he liked it so he specifically wanted to welcome the diplomat with a bɔbɔɔbɔ ensemble. I declined the request because it was Christmas and it will be difficult to get my drummers. I would have earned some dollars that Christmas Eve. (TMP)*

Basically, Amposah wanted instrumental loops of individual *bɔbɔɔbɔ* supporting drum instruments as well as the entire instruments together for rehearsals and performance. He also wants the loops of the master drum pattern which he believes is most difficult to play. He simply wants to download these loops onto his mobile phone and use applications that could change the tempo of the loops to suit the progress of his performance.

4.2.5 Music Composition (MC)

Osoode revealed that compositions with Ghanaian traditional instrumental elements are commonplace and rhythmic elements in *bɔbɔɔbɔ* musical instruments are mostly

adopted for choral and popular music compositions in music notation software programmes like Finale and Sibelius. Expanding on this Osoode said:

> *It is easy to notate the rhythmic pattern of the supporting drums of bɔbɔɔbɔ musical instruments, but notating the master drum variations is most difficult since it entails complex rhythmic structures. I have wanted to score some variations of the master drum for a composition in the finale 2012 but due to its length and complex rhythmic structure I only scored for the supporting drums and even that one I was not sure of some of the patterns. I want websites where I can download MIDI files of these complex traditional instrumental variations so that I can easily import them into the notation software programmes. (MC)*

Osoode confidently described his expertise to import and organize the MIDI files in Finale 2012 and gladly wished there could be MIDI packs and notation packs for the rhythmic elements of *bɔbɔɔbɔ* musical instruments. He further disclosed that this will give him complete authority over the complexities that he has been encountering when he tries to notate *bɔbɔɔbɔ* master drum variation for compositional purposes. Again, Osoode made it clear that composers like himself in Ghana mostly alter Western and foreign Western MIDI packages and notation files to generate Ghanaian traditional instrumental rhythmic structures for music compositions in software notation programmes like Finale and Sibelius.

4.3 Outcome of the Interviews

The engagement with the five (5) respondents revealed profound ways the music educator, music student, music producer, music performer and music composer wanted to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms. The ideas of use as discussed above are presented below.

4.3.1 Ideas from the Music Educator

a) A website should provide images and descriptions of *bɔbɔɔbɔ* musical instruments from sufficient angles so that teachers can easily send website links to students to study, recognise and describe the musical instruments.

b) Websites can also be designed with images and descriptions of *bɔbɔɔbɔ* musical instruments' playing positions and instrument handling to show the proper method for interacting with *bɔbɔɔbɔ* musical instruments.

c) Before introducing students to the playing of the instrumental patterns, preliminary videos of *bɔbɔɔbɔ* musical instrument playing techniques can be organized on a website for students to watch and emulate. This will help students master the various skills involved in playing the instruments.

d) Students can be taught how to play the instrumental patterns of *bɔbɔɔbɔ* musical instruments through observing and imitation using instructional videos organized on a website.

e) The instrumental patterns for *bɔbɔɔbɔ* musical instruments can be demonstrated in videos at slow and moderate tempos so that students can easily mimic and practice without the instructor's human presence.

f) The instrumental patterns for *bɔbɔɔbɔ* musical instruments should be demonstrated in videos both with and without metronomes so that students can learn and practice both methods respectively to increase their tempo consistency.

g) For students to comprehend the placements of *bɔbɔɔbɔ* musical instruments in an ensemble right from the learning stage, the sounds of the instruments should be recorded using the proper equipment and technique to depict the natural auditory structure of the staged *bɔbɔɔbɔ* ensemble.

h) It should be possible to create a website for *bɔbɔɔbɔ* musical instruments accessible both online and offline so that students can use it whenever and whenever they need to.

i) All sounds and visuals of *bɔbɔɔbɔ* musical instruments can be made downloadable for students to download onto their computers and mobile phones for educational purposes.

4.3.2 Ideas from the Music Student

a) There are a lot of practical music lessons organised on digital platforms such as websites and mobile applications.

b) Music students are already learning how to play musical instruments such as drum sets, keyboards and saxophones on digital platforms such as websites and mobile applications.

c) Practical lessons on digital platforms can be made downloadable and can be saved on digital platforms for both online and offline interactions.

d) Students want the sounds and visuals of *bɔbɔɔbɔ* musical instruments as a companion during the practical examinations in drumming.

e) Students want to keep the sounds and visuals of *bɔbɔɔbɔ* musical instruments as part of their teaching and learning materials after their Music Education Programme.

f) Students can learn and rehearse how to play *bɔbɔɔbɔ* musical instruments without the presence of their instructor.

4.3.3 Ideas from the Music Producer

a) Music producers can use the sounds of *bɔbɔɔbɔ* musical instruments when they are properly recorded using the appropriate tools.

b) Varieties of music production tones can be extracted from the sounds of *bɔbɔɔbɔ* musical instruments which are appropriately recorded and digitally manipulated.

c) The tones should be malleably manipulated digitally to create room for music producers to further process these tones for music production purposes.

d) The tones of *bɔbɔɔbɔ* musical instruments can be uploaded into VSTi's such as Battery 4 and Kontakt 5 for music production using a project studio setup.

e) Varieties of music production loops can be extracted from the sounds of *bɔbɔɔbɔ* musical instruments which are appropriately recorded and digitally manipulated.

f) The loops should be malleably manipulated digitally to create room for music producers to further process these tones for music production purposes.

g) The loops of *bɔbɔɔbɔ* musical instruments can be imported into DAWs such as Cubase 11, Protools 12, FL Studio and Bandlab.

4.3.4 Ideas from the Music Performer

a) When the sounds of *bɔbɔɔbɔ* musical instruments are recorded properly with the right equipment, music performers can play the sounds on mobile devices and computers for musical performances.

b) Tones of *bɔbɔɔbɔ* musical instruments can be created out of properly recorded and digitally manipulated sounds for musical performance.

c) The loops created out of sounds of *bɔbɔɔbɔ* musical instruments properly recorded can be uploaded into software programmes like Ableton Live for *bɔbɔɔbɔ* ensemble performance.

d) Loops of *bɔbɔɔbɔ* musical instruments can be used for musical performances by playing them on mobile devices and laptops using software programmes like the Virtual DJ.

e) The loops of *bɔbɔɔbɔ* musical instruments can be used for rehearsals and can assist in crafting *bɔbɔɔbɔ* dance choreography.

f) *Bɔbɔɔbɔ* dance can be organized without the drummers' presence.

g) The tones and loops of *bɔbɔɔbɔ* musical instruments can be imported into loop stations and synthesizers for musical performances.

4.3.5 Ideas from the Music Composer

a) MIDI files can be drafted from the loops of *bɔbɔɔbɔ* musical instruments in DAWs.

b) Drafted MIDI files *bɔbɔɔbɔ* musical instruments can be imported into music notation software programmes for music compositions.

c) A score can be generated from the loops *bɔbɔɔbɔ* musical instruments in DAWs and exported as XML files for music compositional purposes.

d) Rhythmic patterns of *bɔbɔɔbɔ* musical instruments can be imported and used for compositions without scoring them.

e) Music composers can easily score for the master drum variations by importing XML files or MIDI files of the master drum variations of *bɔbɔɔbɔ* musical instruments.

4.4 Selecting Facility and Equipment to Create the Digital Platform

The creative design directed the selection of the audio-visual facility in the Department of Music Education, University of Education, Winneba based on the Two-Hand Steering Digital Platform Model because the space had a conventional acoustic treatment that minimized resonance and prevented unnecessary reverberations. Since the study wanted to maintain the most natural sonic and visual features of the sounds and visuals of *bɔbɔɔbɔ* instruments, it was expedient to use a facility that preserved the sonic and visual figures of the instruments with little room effect and sonic or visual noise. In this sense, the researcher through a reflexive means selected the most acoustically treated and well-lit facility in the Department, the Audio-Visual Centre. The researcher with the respondents engaged for the study explored the various studio facilities in the department and the Audio Visual facility was selected for the study. The Audio Visual Centre is approximately 40 feet x 60 feet room with an acoustic ceiling and thick woollen carpet which help to reduce the reflection of sound. Although the space is not soundproofed, it is difficult for sounds outside to interfere with recordings in the Audio Visual Centre because of its location. The space had adequate square LED downlights and this contributed to good photography and videography. Sticking strictly to the creative design, the Audio-Visual Centre was selected for the audio and visual recording, digitisation and digitalisation of the sounds and visuals of *bɔbɔɔbɔ* instruments.

Figure 4:The Audio Visual Centre, Technology Block, UEW, Central Campus

After the selection of the facility, according to the creative design, the researcher through a reflexive manner selected appropriate equipment for the recording and digitisation of the sounds and visuals of *bɔbɔɔbɔ* instruments based on the Two-Hand Steering Digital Platform Model. The researcher and the respondents earnestly explored the possible audio and visual equipment in the Department through a back-and-forth means to select the audio and visual equipment for the expedition. After a frantic exploration of the equipment and instruments, the following audio equipment and

software programmes were selected out of various equipment and software programmes for the audio recording and digitisation;

- One (1) Midas M32 Digital Mixer Board,
- Three (3) Rode NT2-A condenser microphones,
- One (1) Rode NTK large-diaphragm tube condenser microphone,
- A pair of Yamaha HS8 W 8-Inch Powered Studio Monitor Speaker,
- One (1) AKG K72 Closed-Back Studio Headphones,
- Three (3) Audio-Technica ATH-M50X,
- Six (6) microphone stands,
- One (1) HP Desktop Pro G2 Microtower PC - Core i5-8400 / 4GB RAM / 1TB HDD,
- Steinberg Cubase 11 Digital Audio Workstation,
- Klanghelm Volume Unit (VU) meter
- Izotope Ozone Neutron 3 resonance remover
- Waves Non-Linear Summing
- Solid State Logic (SSL) dynamic compressor

Likewise, the selection of the visual equipment and software programmes, according to the creative design, occurred in a reflexive manner. Appropriate visual equipment and software programmes for the recording and digitisation of the visuals of *bɔbɔɔbɔ* musical instruments were based on the Two-Hand Steering Digital Platform Model. To choose the visual equipment for the expedition, the researcher and the respondents explored the Department's potential visual equipment in a back-and-forth fashion. The following visual equipment and software programs were chosen from an array of visual equipment and software programmes after mindful considerations.

- One (1) Canon EOS 6D Mark II DSLR Camera,
- One (1) Canon EF 50mm f/1.4 USM Prime Lens,
- One (1) PXW-Z190 Handheld Camcorder - 4K HDR,
- One (1) DJI RSC 2 Gimbal Stabilizer Pro Combo,
- One (1) tripod stand,
- Two (2) 64-gigabyte memory
- Adobe Photoshop 2020
- Adobe Premiere Pro 2020.

As disclosed above the selection of these items was based on the Two-Hand Steering Digital Platform Model which brought to bear the relevant information about existing digital platforms and respondents' needs and therefore coxed the selection of appropriate facility and equipment. The description of the equipment and the reason for their selection which emanate from the Two-Hand Steering Digital Platform Model is presented below.

i.

Figure 5: Midas M32 Digital Mixer Board

Source: Ltd., Magnolia International. “Product: M32.” *Midas*, www.midasconsoles.com/product.html?modelCode=P0B3I. Accessed 1 Sept. 2023.

The Midas M32 is a 32-channel digital mixer with 32 mix buses, 16 outputs, and up to 40 simultaneous analogue input channels. It has sixteen (16) MIDAS-designed mic preamps and onboard motorized 100mm faders which provide optimized headroom for a satisfactory signal-to-noise ratio. These features allowed the sounds of the *bɔbɔɔbɔ* musical instruments to be recorded with high fidelity without clipping and a good signal-to-noise ratio was achieved. This digital mixer board offered industry-standard

audio quality and a simple workflow for converting the analogue signals from the microphones to digital signals on the computer. Also, due to its internal digital audio processing system and ability to record at 96khz sampling rate and 48khz bit depth onto the computer's hard drive, the Midas M32 digital mixer was selected by the researcher as the digital audio interface to record and digitised the sounds of *bɔbɔɔbɔ* musical instruments.

ii.

Figure 6: Rode NT2-A condenser microphone
Source: Microphones, RØDE. "NT2-A: Multi-Pattern Large-Diaphragm Condenser Microphone." *RØDE*, rode.com/en/microphones/studio-condenser/nt2-a. Accessed 1 Sept. 2023.

Rode NT2-A is a condenser microphone suitable for recording vocalists, acoustic instruments, and amplifiers. It is created for professional studio applications. It has a noise-reduction high-pass filter. Its variable-frequency high-pass filter and a -20dB pad

are additional features of the NT2-A that enable users to tailor their recordings for any given sound source. This microphone was able to accurately capture the nuances and details of the *bɔbɔɔbɔ* musical instruments, it was also a great option for recording the sounds of *bɔbɔɔbɔ* musical instruments because of the ability to easily switch between the various polar patterns. Additionally, the NT2-A enabled broad frequency response and a low noise floor, both of which contributed to the recording of the sounds of the *bɔbɔɔbɔ* musical instruments clearly and precisely.

iii.

Figure 7: Rode NTK large-diaphragm tube condenser microphone
Source: *Rode Ntk Large-Diaphragm Tube Condenser Microphone*, www.amazon.com/Rode-NTK-Cardioid-Condenser-Microphone/dp/B0002DUQOU. Accessed 1 Sept. 2023.

The Rode NTK is a large-diaphragm tube condenser microphone that has a valve-driven preamp with variable impedance and a gold-sputtered capsule (high or low). The microphone's objective is to record acoustic instruments and provide a vintage tone that is realistic and detailed. The NTK is a great option to record a diversity of sources, including vocals, guitar, drums, percussion, strings, and more. The whole spectrum of

drums and percussion instruments including Ghanaian traditional instruments can be recorded using the Rode NTK microphone due to its wide frequency response. It was also selected to record the sounds of the *bɔbɔɔbɔ* musical instruments since it has a very low noise floor and can capture very delicate details of the sounds of the *bɔbɔɔbɔ* musical instruments with clarity and maintain the organic saturation of the sounds.

iv.

Figure 8: Yamaha HS8 W 8-Inch Powered Studio Monitor Speaker
Source: "Yamaha HS8 8 Inch Powered Studio Monitor - Black." *Sweetwater*, www.sweetwater.com/store/detail/HS8--yamaha-hs8-8-inch-powered-studio-monitor-black. Accessed 1 Sept. 2023.

The Yamaha HS8 Studio Monitor is designed to deliver precise sound reproduction for a range of audio applications. The speaker has a bi-amplified setup, an 8-inch woofer, and a 1-inch tweeter, which together produce a frequency range of 45 Hz to 30 kHz. For better sound dispersion, the speaker also has Yamaha's cutting-edge Waveguide technology and a top-tier amplifier. The Yamaha HS8 is made for home studios and recording facilities and can be used in a range of production settings. The speaker's flat frequency response helped to ensure that the sound of the *bɔbɔɔbɔ* musical instruments

was faithfully reproduced, and its frequency response range (45 Hz - 30 kHz) was large enough to suit the sonic nature of all the *bɔbɔɔbɔ* musical instruments. Due to these qualities, the researcher selected this monitor system to monitor the recording process of the sounds of the *bɔbɔɔbɔ* musical instruments to prevent sonic deception.

v.

Figure 9: AKG K72 Closed-Back Studio Headphones
Source: *AKG K72 Closed-Back Studio Headphones - Amazon.Com*, www.amazon.com/Akg-K72-Closed-Back-Studio-Headphones/dp/B01BLSAFHC. Accessed 1 Sept. 2023.

The AKG K72 Closed-Back Studio headphone is a studio-quality headphone made for professional mixing and recording. They are lightweight for extended listening sessions, with a closed-back design to reduce sound leakage and give exceptional isolation and a comfortable self-adjusting headband. The K72 is also equipped with a high-performance 40mm speaker and a 32-ohm impedance, making it perfect for use with a variety of audio sources. When recording percussion, the AKG K72 closed-back studio headphones can be utilised as an isolated monitoring tool. The closed-back construction of the headphones aids in creating a tight seal around the ears, which blocks out outside noise and gives an accurate depiction of the recorded sound. The

headphones also have a wide frequency range, which allowed you to get a good sense of the full range of the *bɔbɔɔbɔ* musical instruments sounds being recorded therefore they were selected as another monitor system to double-check the sound recordings.

vi.

Figure 10: Audio-Technica ATH-M50X
Source: "Ath-M50X." *Audio*, www.audio-technica.com/en-us/ath-m50x. Accessed 1 Sept. 2023.

The Audio-Technica ATH-M50X is a set of over-ear monitor headphones for studio, home and live-sound applications. It has unique 45 mm large-aperture drivers with copper-clad aluminium wire voice coils and rare earth magnets. The headphones offer good noise isolation in a busy environment and long frequency response. The researcher also selected this headphone as a double backup for the first headphone because this headphone made it possible to concentrate on the sound of the instrument being recorded because of its closed-back design even in a noisy environment. Due to these qualities, this headphone was selected as another monitor system for the sound recordings of *bɔbɔɔbɔ* instruments.

vii.

Figure 11: Hercules Microphone Stand
Source: "Studio & Recording." *Sweetwater®*, www.sweetwater.com/c396--Hercules_Stands--Microphone_Stands. Accessed 1 Sept. 2023.

The Hercules Microphone Stand is a robust, adjustable, and collapsible microphone stand created to offer a safe and solid basis for all sorts of microphones. It has an adjustable height, strong metal construction and a folding tripod design. Additionally, the stand has a rubberized base to reduce sliding and vibration and a quick-release boom arm for simple angle adjustment. Heavy microphones can be held with the Hercules Microphone Stand because of its built-in heavy-duty steel design and adjustable counterweight. This counterweight provides stability and can be adjusted to accommodate the weight of the microphone. The weight of the microphones used in the recording process and the microphone techniques employed during the recording process informed the selection of this type of microphone stand.

viii.

Figure 12: HP Desktop Pro with Cubase 11 DAW
Source: "HP Pro Desktops and Aio Series." *HP Pro Desktops and AiO Series | HP® Official Site*, www.hp.com/us-en/desktops/business/prodesks.html. Accessed 1 Sept. 2023.

An HP Desktop computer equipped with the latest Intel Core processors was selected as the computer device to host the recordings and the digitised sounds and visuals of *bɔbɔɔbɔ* musical instruments. This computer is an expandable tower computer that offers enterprise-level performance with the flexibility to configure the system to match your needs. It had a memory of eight (8) gigabytes and the hard disk capacity was 1 terabyte. Among other features, it operated with the Windows 10 operating system which made the connectivity between the digital mixer and the computer comfortable for recording, digital storage and easy manipulation of the digitised sounds and visuals of *bɔbɔɔbɔ* instruments.

ix.

Figure 13: Cubase 11 Digital Audio Workstation
Music, Computer. "Steinberg Cubase 11 Review." *MusicRadar*, 1 Feb. 2021, www.musicradar.com/reviews/steinberg-cubase-11.

The Steinberg Cubase 11 Digital Audio Workstation was selected and installed on the selected computer as the Digital Audio Workstation (DAW) for the audio recording, digital manipulation and editing of the sounds of *bɔbɔɔbɔ* musical instruments. This software programme supports a 96 kHz sample rate and 48-bit depth recording which provided the opportunity for the sounds to be sampled at a higher rate to maintain most of the overtones of *bɔbɔɔbɔ* musical instruments.

x.

Figure 14: Canon EOS 6D Mark II DSLR Camera
Source: "Eos 6d Mark II." *Canon EOS 6D Mark II | Canon U.S.A., Inc.*, www.usa.canon.com/shop/p/eos-6d-mark-ii. Accessed 1 Sept. 2023.

Canon EOS 6D Mark II is a digital single-lens reflex camera with a vari-angle touchscreen LCD, an enhanced autofocus system and a full-frame sensor with greater resolution. It is a full-frame DSLR camera that is intended for both photography and videography. It is well-suited for low-light photography and filmmaking with its full-frame 26.2MP sensor and a broad ISO range of 100–40000. Additionally, it features a dual-pixel auto-focus system for quick and precise still photos or videos. Furthermore, it can capture full HD 1080p video at up to 60 frames per second. These qualities qualified it to be selected to record both images and videos of *bɔbɔɔbɔ* musical instruments.

xi.

Figure 15: Canon EF 50mm f/1.4 USM Prime Lens
Source: "EF 50mm f 1.4 USM." *Canon EF 50mm f/1.4 USM | Canon U.S.A., Inc.*, www.usa.canon.com/shop/p/ef-50mm-f-1-4-usm. Accessed 1 Sept. 2023.

The Canon EF 50mm f/1.4 USM Prime excels in low light and portrait photography. Good photos and video can be taken using the Canon EF 50mm f/1.4 lens. It is a fantastic option for low-light shooting and provides a variety of creative options. Additionally, it can take clear pictures with superb colour and contrast rendition. This lens was selected based on its capacity to take accurate pictures and record videos of *bɔbɔɔbɔ* musical instruments with splendid colours and contrast.

xii.

Figure 16: PXW-Z190 Handheld Camcorder - 4K HDR
Source: "PXW-Z190 Handheld Camcorder - 4K HDR - Sony Pro." *Handheld Camcorder - 4K HDR - Sony Pro*, pro.sony/ue_us/products/handheld-camcorders/pxw-z190. Accessed 1 Sept. 2023.

PXW-Z190 Handheld Camcorder- 4K HDR is a professional camcorder created for high-end video applications. It has 14.2 megapixels and the sensor in this camera produces excellent 4K images with high sensitivity, minimal noise, and a broad dynamic range. It can record 4K resolution video at up to 30 frames per second and full HD resolution at up to 60 frames per second. Since this camcorder could record 4K video, with wide zooming possibilities it was selected to record videos of *bɔbɔɔbɔ* musical instruments.

xiii.

Figure 17:DJI RSC 2 Gimbal Stabilizer Pro Combo
Source: *DJI RSC 2 Gimbal Stabilizer pro Combo - B&H Photo Video*, www.bhphotovideo.com/c/product/1595379REG/dji_cp_rn_00000124_02_rsc_2_gimbal_stabilizer.html. Accessed 1 Sept. 2023.

The DJI RSC 2 Gimbal Stabilizer Pro Combo is a professional camera stabilizer. It is intended to provide the best level of control and stabilization for cameras. It has an RSC 2 gimbal, a dedicated mounting plate, an extension arm, and a variety of mounting choices. The dual-axis architecture of the RSC 2 enables fine control of speed and direction in addition to smooth tilting and panning motions. This device was selected to hold the Canon EOS 6D Mark II DSLR camera for smooth control and stability during the video recording of the *bɔbɔɔbɔ* instruments.

xiv.

Figure 18: Tripod Stand
Source: "The Figural Classes: Tripod, Kraters, Basin, Cista, Protome, Utensil Stands, Candelabra and Votive Statuettes." *Amazon*, Philipp von Zabern, 1986, www.amazon.com/tripod-stands/s?k=tripod%2Bstands.

The tripod stand is a device with three (3) legs made to support and aid in maintaining the stability and security of the cameras and camcorders. It makes it possible to obtain a variety of heights and angles when taking pictures and videos. This device was selected to support the PXW-Z190 Handheld Camcorder - 4K HDR to get a stable video.

xv.

Figure 19: 64-gigabyte memory
Source: "64 GB and DDR4 Memory (RAM)." *BestBuy.Com*, www.bestbuy.com/site/searchpage.jsp?browsedCategory=abcat0506000&id=pcat17071&qp=memorycapacitytotal_facet%3DMemory+Capacity+%28Total%29~64+GB%5Etypeofmemoryram_facet%3DMemory+Type~DDR4&st=categoryid%24abcat0506000. Accessed 1 Sept. 2023.

The 64 gigabyte Sandisk memory is a type of computer memory, or RAM, that stores data for quick access. It is typically used in desktop and laptop computers. The researcher selected this memory card to temporarily store the digital pictures and videos and also to enable the researcher to transfer the pictures and videos to the computer for digital manipulation.

xvi.

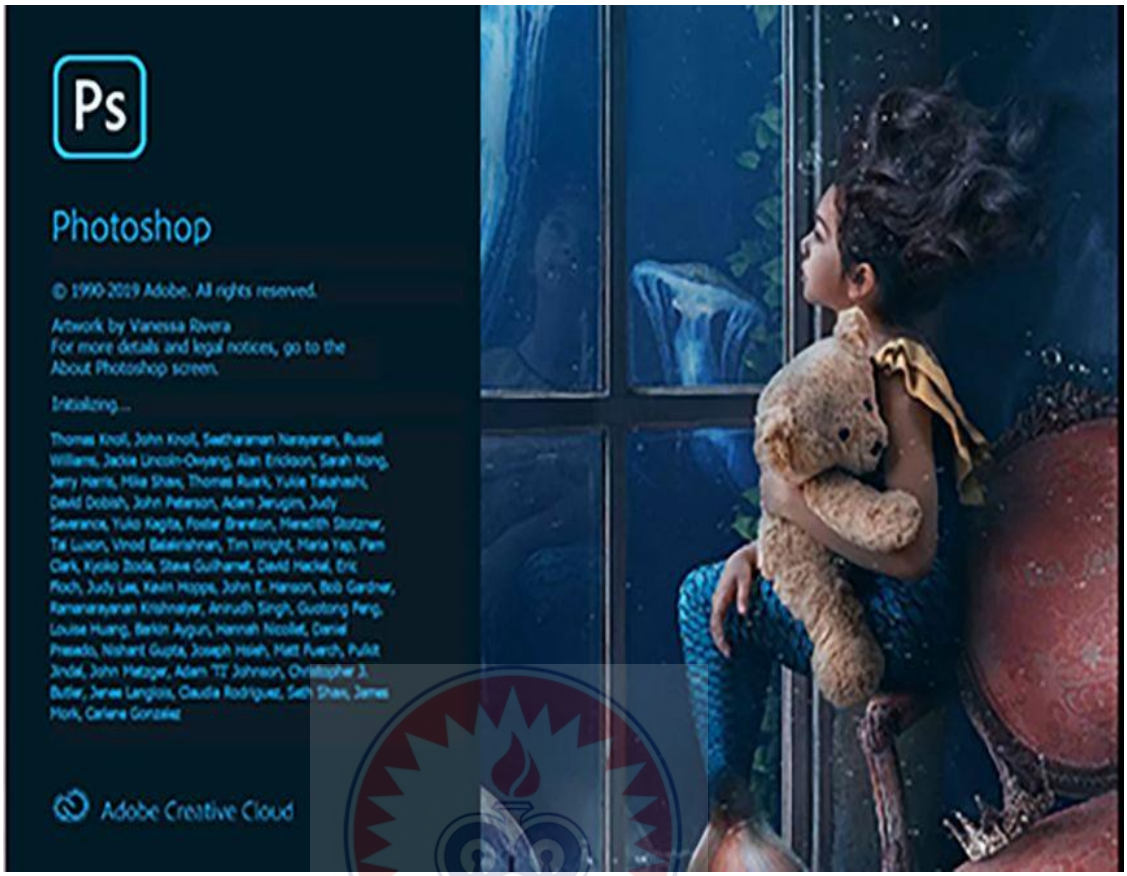


Figure 20: Abobe Photoshop 2020
Source: *Official Adobe Photoshop - Photo & Design Software*, www.adobe.com/products/photoshop.html. Accessed 1 Sept. 2023.

The researcher selected Adobe Photoshop 20201 as the software programme to edit the digital images of *bɔbɔɔbɔ* instruments. This graphic and picture editing software programme has state-of-the-art features that provide accurate picture quality stability even after excessive digital manipulations. For instance, the researcher used the crop tool to cut out unwanted parts of the images of the instruments. Also, the clone stamp tool was used by the researcher to remove any blemishes or unwanted objects from the image that distorted the visual outlook of the instrument. These possibilities led the researcher to select this software programme for the editing of the digital images of *bɔbɔɔbɔ* musical instruments.

xvii.

Figure 21: Abobe Premiere Pro 2020
Source: *Official Adobe Photoshop - Photo & Design Software*, www.adobe.com/products/photoshop.html. Accessed 1 Sept. 2023.

The researcher selected Adobe Premiere Pro as the video editing software programme to digitally manipulate the videos of *bɔbɔɔbɔ* instruments which were recorded for educational purposes. This video editing software programme is a professional-grade video editing software programme that offers a wide range of features and tools. It has an intuitive, user-friendly interface that makes it easy to use. It also offers a wide range of advanced features such as creative effects, 4K and higher resolution support and support for multiple formats. Most especially its ability to create multiple video

windows in a scene to enable different perspectives to be seen at a goal made the researcher select this programme.

4.5 Techniques Used for the Recording and Digitisation

Established on the Two - Hand Steering Digital Platform Model and executed according to the creative design, reflexively the researcher selected techniques for the recording and digitisation of the sounds and visuals of *bɔbɔɔbɔ* instruments. After selecting the Audio Visual facility and the equipment the researcher with knowledge in audio and visual recording as well as digital audio and video manipulation and editing explored appropriate techniques to record and digitize the sounds and visuals of *bɔbɔɔbɔ* musical instruments with the respondents. This section describes the techniques used in recording and digitising the sounds and visuals of *bɔbɔɔbɔ* musical instruments as the studio-based design demands. It gives an account of how the sounds and visuals were recorded, digitized, manipulated and prepared for digitalisation. The techniques employed by the researcher were fashioned according to the findings from the second research question and the information from the bibliographic and discographic analysis as directed by the Two-Hand Steering Digital Platform Model. As part of the techniques, it is important to describe the audio recording and digitisation setup as well as the video recording and digitisation setup for an adequate understanding of the recording and digitisation process.

(a) Audio Recording and Digitisation Setup

The audio recording and digitisation setup used the general project studio or portable studio setup. The signal flow for this setup started with the conversion of the analogue signal into an electrical signal by the microphones. The next stage was the conversion

of the electrical signal to a digital signal by the digital mixer board. The sounds of *bɔbɔɔbɔ* musical instruments were digitally recorded, edited and manipulated in Cubase 11 Digital Audio Workstation. The final stage was exporting and storing the digital signals as digital audio files from the DAW onto the computer's hard disk to create the database of digital sounds of *bɔbɔɔbɔ* musical instruments. The monitor or speaker was connected to the digital mixer to audibly monitor the signal during the recording and digitisation processes. Also, the two headsets served as a system for checking the recorded sounds on multiple listening platforms. It is important to note that the capturing of the sound with the microphone is the recording and the conversion of the sound to the digital format by the mixer and its hosting for editing and manipulation in the DAW, as well as the final export and storing on the computer, falls under the digitisation processes.

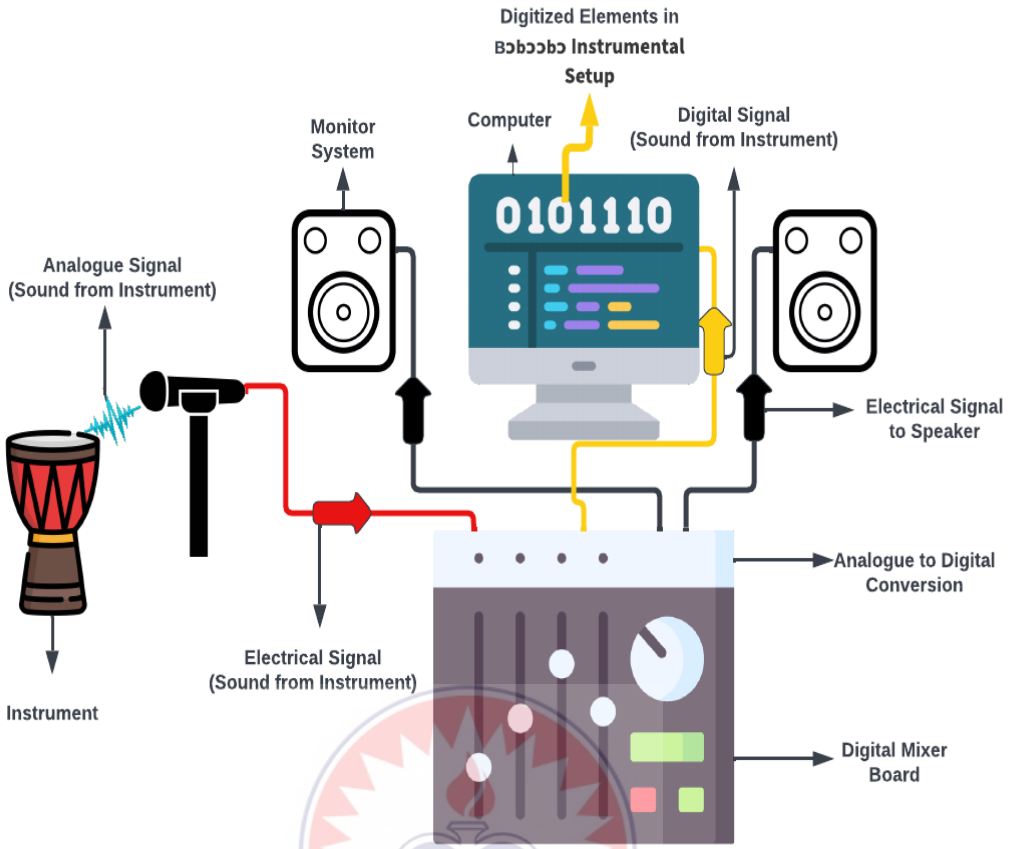


Figure 22: Audio Recording and Digitisation Setup and Signal Flow

(b) Visual Recording and Digitisation Setup

The visual recording and digitisation setup involved the image and video recording, editing and storing setup. The signal flow for this setup started with taking shots of the *bɔbɔɔbɔ* musical instruments and taking videos of the instrumental performance on the *bɔbɔɔbɔ* musical instruments with the digital cameras. The images and the performance were captured by digitally storing them on the memory cards temporarily. The next stage was inserting the memory card into the computer to copy the digitized images and videos onto the computer to edit in Adobe Photoshop and Adobe Premiere Pro respectively. The images were edited and exported onto the hard disk of the computer. The videos were also edited and the sound component of the videos was replaced by

the digitised audio created with the audio recording and digitisation setup since the audio recording capabilities of cameras are always limited to specific frequencies.

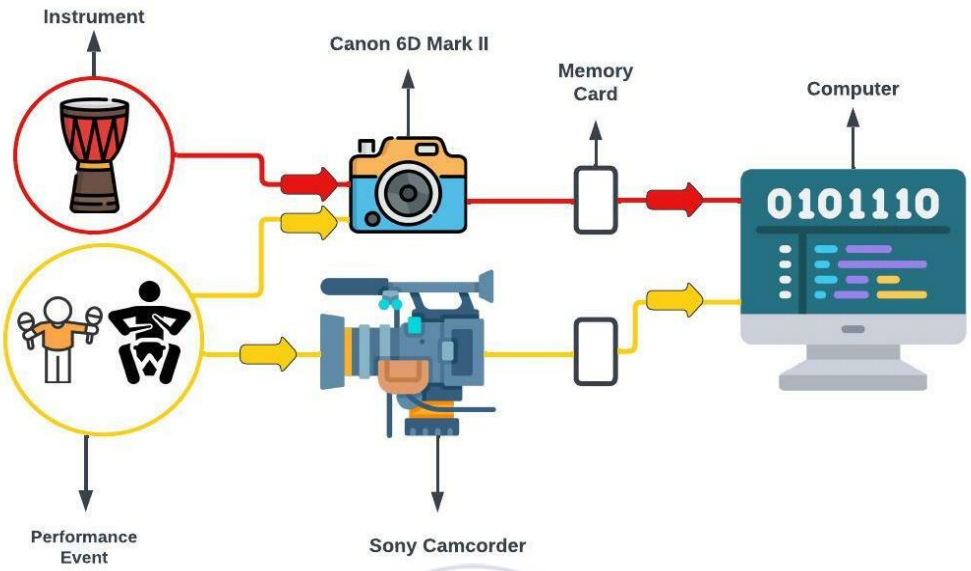


Figure 23: Visual Recording and Digitisation Setup and Signal Flow

The Two-Hand Steering Digital Platform Model served as the underlining principles for the two setups described. These setups were used to record, edit, manipulate and finally export digital sounds and visuals of *bɔbɔɔbɔ* instruments onto the computer hard disk. The next phase of the digitisation process described how specific techniques were used to record and digitise the sounds and visuals for music education, production, performance and composition activities on digital platforms.

4.4.1 Techniques Used in Recording and Digitising the Sounds and Visuals of Bɔbɔɔbɔ Musical Instruments for Music Education

Again, reflexivity was instituted in adopting the techniques for recording and digitisation. Regarding the digitisation and recording of the sounds and visuals for use

in music education, the Canon 6 D Mark II camera was used to take pictures of the musical instruments. Maintaining a significant distance proportional to the size of the instrument and the angle of perspective, three (3) kinds of pictures were taken for each *bɔbɔɔbɔ* drum instrument, the side view of the instrument, the top view and the top and side view together. This was to ensure three-dimensional perspectives of the drum instruments especially as some Ghanaian traditional musical instruments look similar but different in sounds and purpose. For the idiophones, two perspective pictures were taken to enable an adequate view of the instruments. This was to enable learners to have adequate perspectives of *bɔbɔɔbɔ* musical instruments to enable easy and accurate identification. After the images were captured onto the memory card, they were uploaded into Adobe Photoshop and the images were cropped out of the background. The images were isolated from the background and given white backgrounds for learners to easily look at them for a long time and also focus on the musical instruments with ease as suggested by the respondent. Moreover, pictures of how the instruments are handled were also taken to enable the learners to know how to position the *bɔbɔɔbɔ* musical instruments during learning and performance. The blur and sharpen tools were used to adjust the focus of the images for the pictures of the instruments to stand out. Also, the saturation and colour balance tools were used to adjust the colours of the images taken to resemble the natural fresh outlook of the instruments because of the dryness of the wood. After these processes, the images were exported into a dedicated folder on the computer.

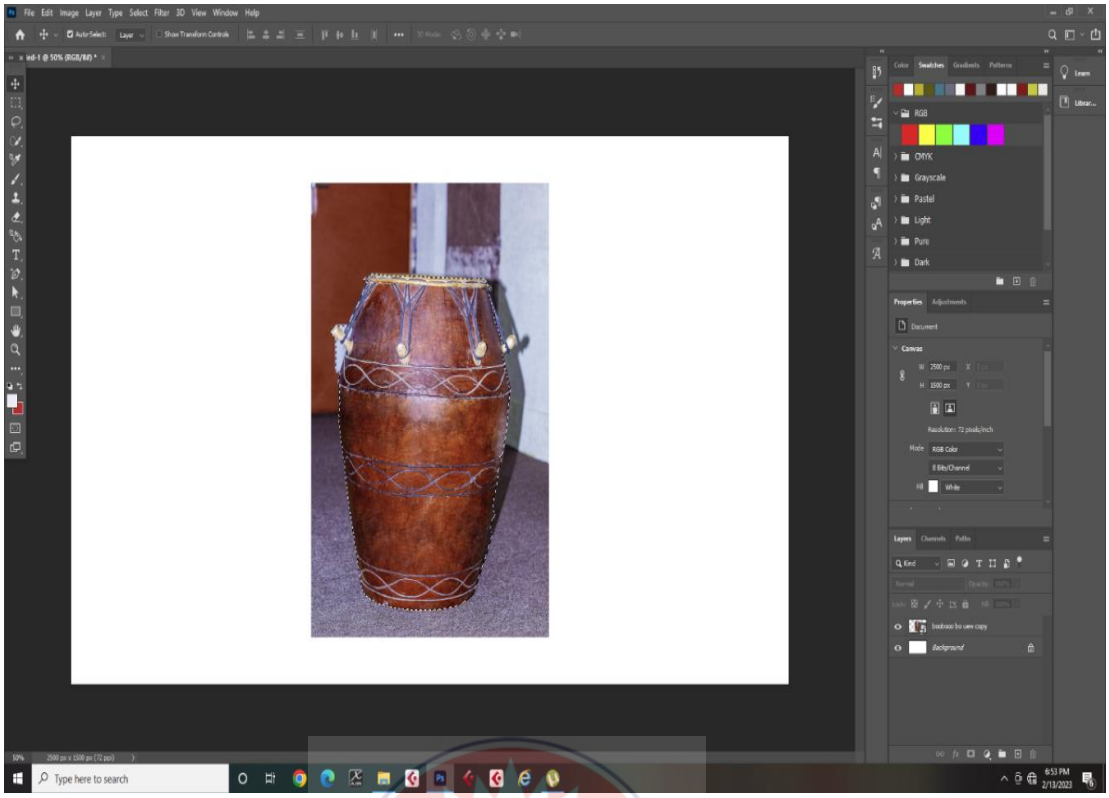


Figure 24: Image of Instrument in Adobe Photoshop

Also, videos on how to play the various musical instruments of *bɔbɔɔbɔ* were taken from two viewpoints using the Conon 6D Mark II and Sony PXW-Z190 Camcorder. This technique was used to capture the playing technique of the instruments from two perspectives. This technique was instigated to capture the instructional performance on the instruments from a wide perspective which captures the performer's position, body movement, instrument position and performer's antiques. Instruments recorded included the *kritsiwa, tigo, akaye, vuvi, asivui* and *vuga.* Also, the close shots provided a close perspective that focuses on how the performer's hand reacts with the instrument. The wider zoom possibility with the Sony PXW-Z190 Camcorder was accurate in capturing the wider perspective and the Canon 6D Mark II which is limited in zooming but strong in focus and Blair was used in capturing the close perspective. Preliminary videos of how to position the *bɔbɔɔbɔ* musical instruments and their playing techniques

were recorded. Next, lessons were structured on the principles of demonstration and imitation and were recorded in 60 and 80 BPM with and without a metronome. These lessons were also recorded using the two cameras from two perspectives as described above. These videos were captured onto the memory card and uploaded into the Adobe Premiere Pro Video editing software programme interface for editing.

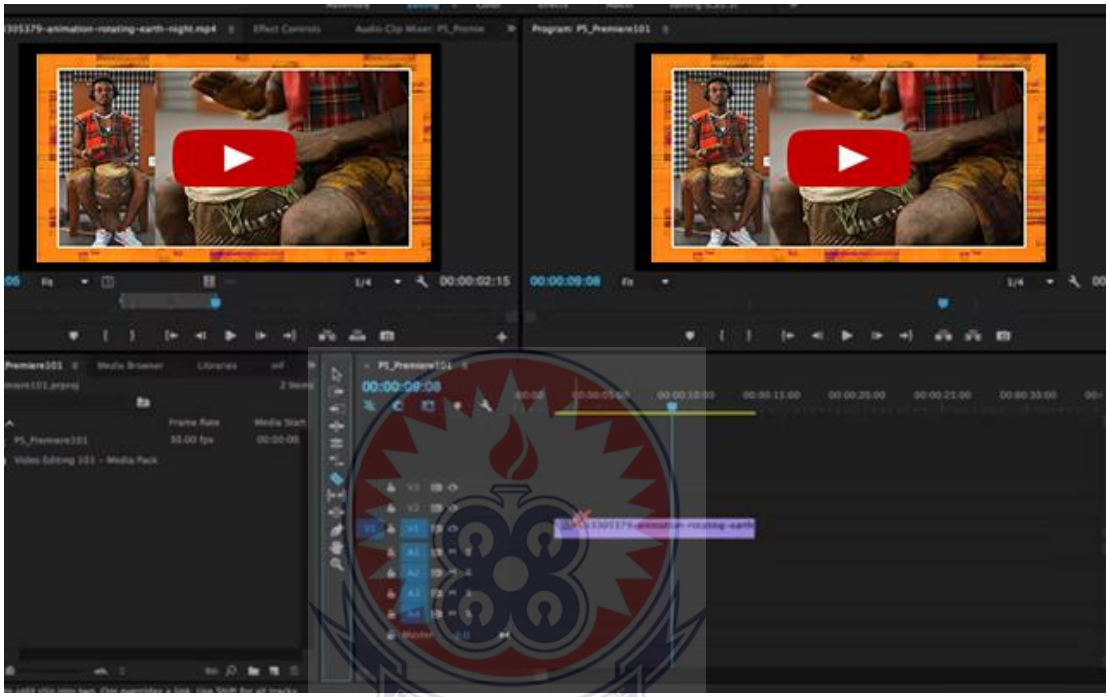


Figure 25: Adobe Premiere Pro interface

It is important to note that although the two cameras recorded the sounds from the instruments when the videos were taken, the sounds recorded by the two cameras were replaced by the sound recorded and digitized by the project studio setup using the spaced pair microphone techniques. The visual of the instructional lessons was captured and digitized by the camera whereas the audio of the same instructional performance was recorded and digitised by the project studio setup with a spaced pair microphone position.

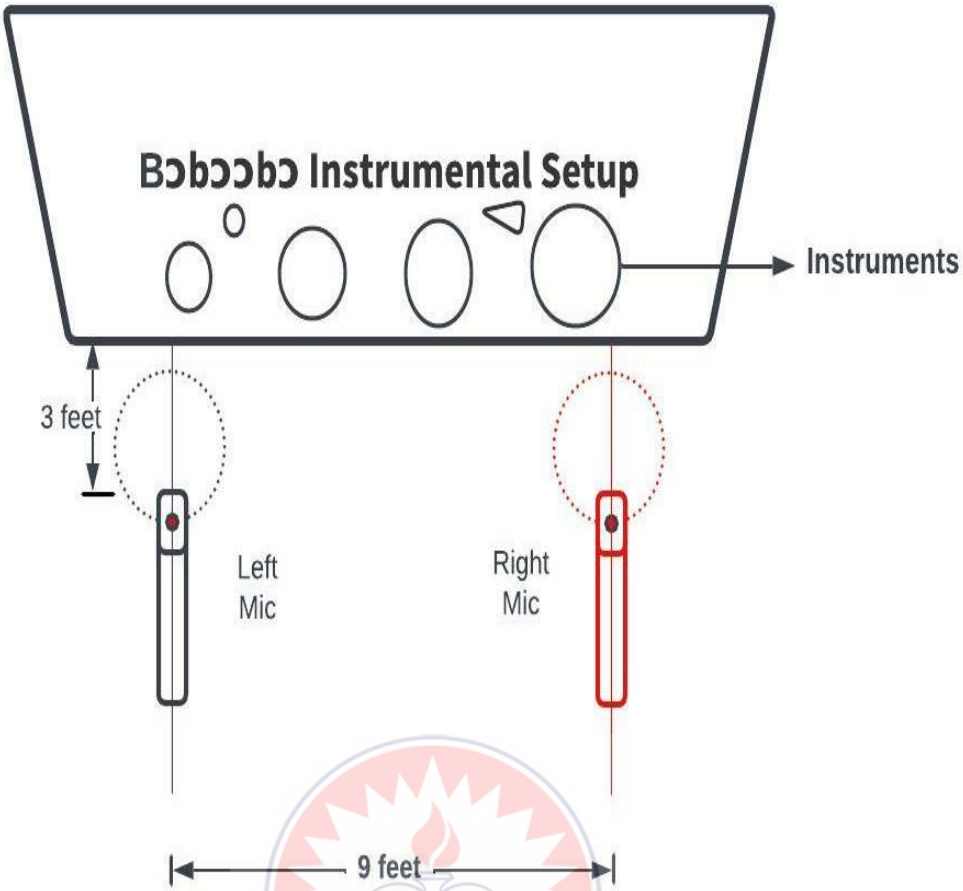


Figure 26: Spaced Pair Microphone Technique

The spaced pair microphone technique was used to record the sounds of the *bɔbɔɔbɔ* instruments for *bɔbɔɔbɔ* drumming lessons. This microphone technique involved placing two identical cardioid microphones nine (9) feet apart and three (3) feet from the instruments. The spaced pair recording technique was used to capture the natural sound of the traditional instruments to create a stereo recording with a wider soundstage. This technique creates a balanced recording that resembles the natural sonic setup for the performance of *bɔbɔɔbɔ*. Considering the performance outfit for *bɔbɔɔbɔ* instrumental setup, the spaced pair microphone technique became necessary. This was intended to give a natural and holistic idea of how the various instruments relate in performance settings. The individual patterns of the instruments for

educational purposes were recorded. Also, as a means to let students comprehend the entire instrumental performance of *bɔbɔɔbɔ* ensembles, the entire instrumental performance was recorded to give the students an idea of how all the musical instruments sound together in a performance setting. Two Rode NTK2-A were used for this recording due to their frequency capabilities. The Rode NTK2-A can capture the frequency range between 20Hz-20kHz which can represent the entirety of the natural sound produced by the instruments in the *bɔbɔɔbɔ* instrumental setup. After replacing the two cameras' sound of the instructional lessons with the spaced pair microphone sound, the videos were labelled and categorically exported into a folder named "Music Education" in the database folder on the computer desktop. The exported digitized instructional videos of *bɔbɔɔbɔ* musical instruments involved the entire instruments performing with one master drum variation to depict how the instruments coordinate in *bɔbɔɔbɔ* ensemble. The instructional videos on the individual instruments were prepared at 60 beats per minute (BPM) and 80 BPM. This was to deliver the instructional videos in a slow tempo which the learner can easily assimilate and also provide a regular real-time tempo for the learner to practice with. The two sets of videos (60 and 80 BPM) were also prepared with and without a metronome. This was to ensure that after the learner learns how to play on time, he or she can also play on time without the metronome. As already stated, this process was actively characterised by reflexivity therefore, the practices of the researcher were reflected upon severally by the researcher as well as the respondents for adjustments and amendments.

4.4.2 Techniques Used in Recording and Digitizing the Sounds of Bɔbɔɔbɔ Instruments for Music Production, Performance and Composition

Six traditional musical instruments were involved in this expedition, the *kritsiwa, tigo, akaye, vuvi, asivui* and *vuga.* This section describes how these instruments were recorded and digitised for music production, performance and composition purposes. Maintaining the project studio set, the researcher used mid-side recording techniques to record the traditional musical instruments. The mid-side is a stereo recording technique that uses a figure-of-eight microphone and a cardioid microphone to capture a stereo sonic image of instruments. The Rode NT2 was switched to the figure-of-eight polar pattern which allows the microphone to capture sound from its two (2) sides.

Figure 27: Rode NT2-A Two Sides (For Figure-of Eight)

The Rode NTK which is a cardioid microphone was placed in front of the instrument and the figure-of-eight microphone (Rode NT2-A) was added at the same spot by placing it to capture the sound of the instruments facing the left and right sides of the Rode NTK cardioid microphone.

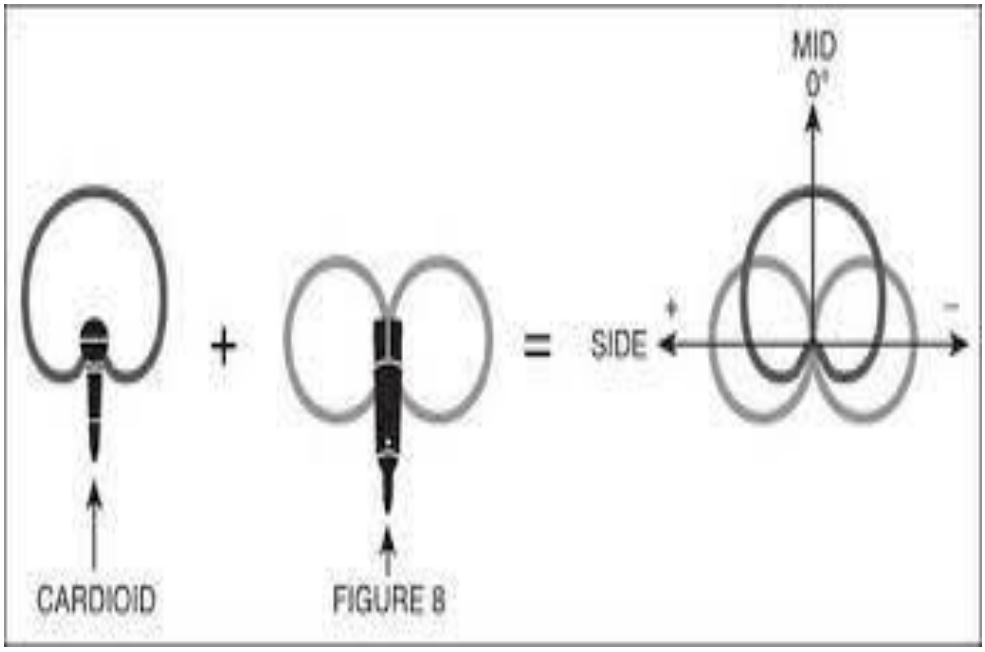


Figure 28: Mid-Side Technique
Source: Houghton, Matt. *Introduction to Mid-Sides Recording*, 1 Sept. 2023, www.soundonsound.com/techniques/introduction-mid-sides-recording.

The Rode NKT was preferred as the microphone to be combined with the Rode NT2-A because its frequency response is almost flat and can adequately capture the organic sound without sonic colouring for digitisation.

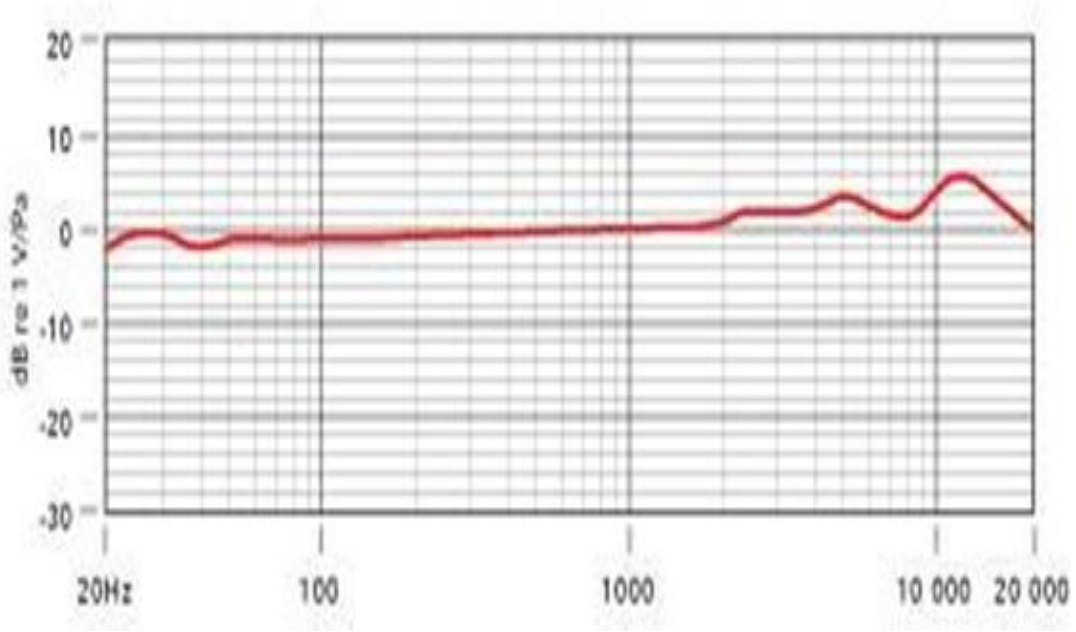


Figure 29: Frequency Response of Rode NTK
Source: White, Paul. *Rode NTK*, 1 Sept. 2023, www.soundonsound.com/reviews/rode-ntk.

The resulting signal was then processed to create stereo sounds of the instruments. The researcher duplicated the digital signal from the Rode NT2-A which is the side microphone and panned the two (2) signals hard left and right. The phase of the left digital signal was then flipped to create the stereo effect needed. The digital signal from the Rode NTK remained panned to the centre and the three (3) digital signals were combined to create the stereophonic effect. These three (3) digital signals were then grouped and one (1) auxiliary output was created for them and named "mid-side" in the Cubase 11 DAW. This technique is popular in recording acoustic instruments for a realistic stereo sound of the instruments from the human perspective. The researcher based on the Two-Hand Steering Digital Platform Model used this technique to capture the elements in *bɔbɔɔbɔ* instrumental setup with maximum stereo fidelity. After recording, the respondents who were selected because of music production and performance activities as well as the researcher perused the sonic characteristics of the

recorded sound to decide whether the technique adequately represented the sonic attributes of the traditional musical instruments. Checking through the Yamaha HS8 studio monitor and the two headsets, the researcher and the respondents found the recorded sounds to be befitting in representing the sonic nature of the *bɔbɔɔbɔ* instruments. Human beings mostly possess two ears which makes them stereophonic, therefore, recording sonic elements for extensive use should consider the human hearing perspective. Also, stereo speaker setups are used in a variety of sonic setups, for example, in home theatres, car speakers, computer speakers and live sound front-of-house systems therefore, the researcher used this technique to satisfy the various stereo setups for musical activities.

The respondents for music production and performance revealed that they needed tones and repeating sound segments (loops) of the sound of *bɔbɔɔbɔ* musical instruments. Therefore, the sounds of *bɔbɔɔbɔ* instruments and their patterns were recorded with the mid-side configuration and digitally manipulated us tones and loops. Each musical instrument had three (3) separate digital audio tracks in the Cubase 11 DAW, one from the cardioid Rode NTK and two from the figure-of-eight Rode NT2-A. These tracks were grouped and an auxiliary track was created for them respectively according to the names of the instruments. Four (4) measures of the supporting drum patterns (*kritsiwa, tigo, akaye, ʋuvi* and *asivui*) and the *Sakanadzo* variation of the master drum *(vuga)* were recorded as loops at 80 BPM. Also, the variants of tones that the instruments could produce were recorded as instrumental tones of *bɔbɔɔbɔ* instruments.

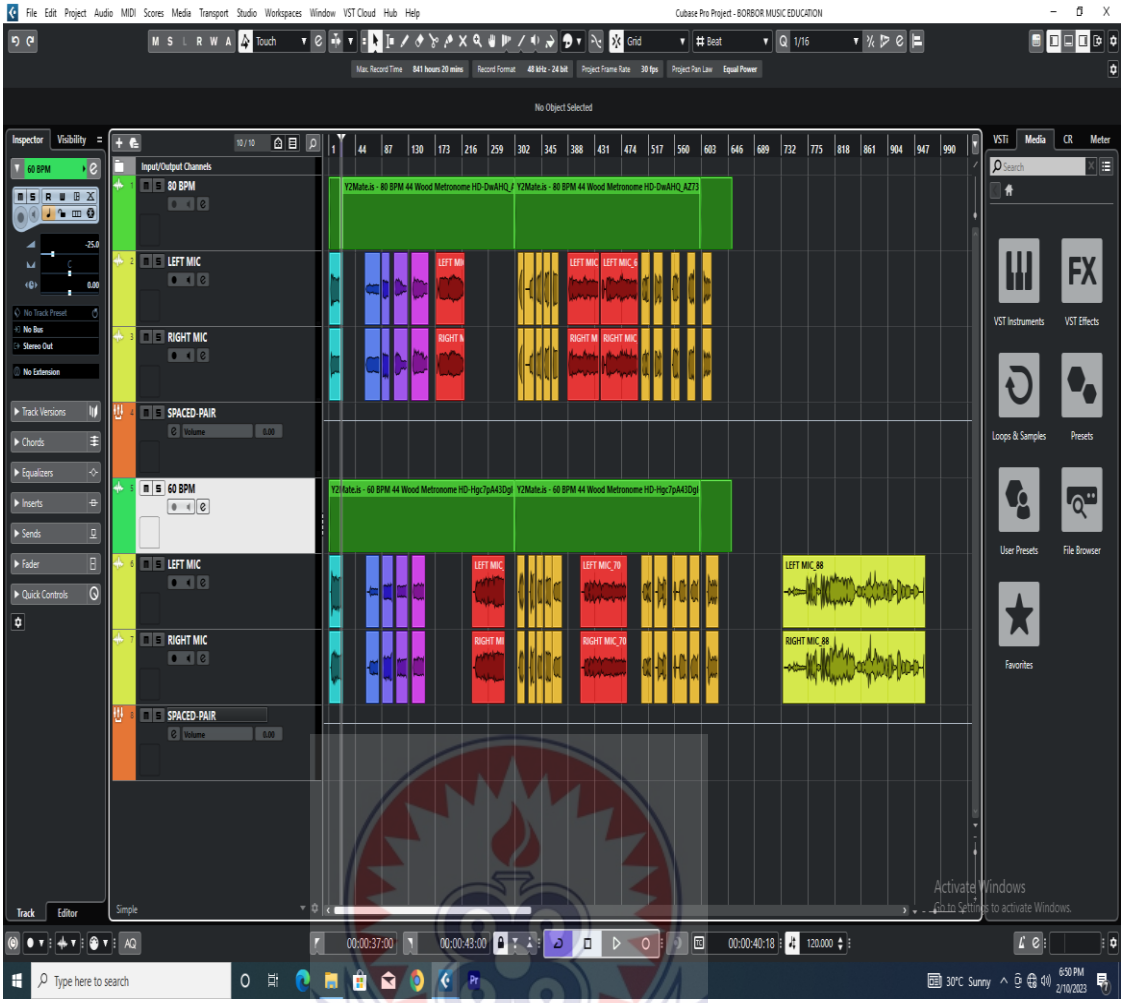


Figure 30: DAW Edit View of the Recorded and Digitally Manipulated Signals

After recording the instrumental loops and tones in *bɔbɔɔbɔ* instrumental setup with this microphone configuration using the project studio setup into the Cubase 11 DAW, the digital audios were digitally manipulated with precision to satisfy how the music producer and the music performer wants to use the digital sounds.

(a) Digitising the Sounds of Bɔbɔɔbɔ instruments for music production

The digitised audios of *bɔbɔɔbɔ* musical instruments sound recorded with the mid-side microphone configuration were digitally manipulated to serve as loops and tones for music production. The Klanghelm Volume Unit (VU) meter was used to regulate the

amplitude of the digital audio to an appropriate digital audio level void of clipping and noise. This was to ensure clean and clear digital sounds.

Figure 31: VU meter
Source: *Klanghelm*, klanghelm.com/contents/products/VUMT.html. Accessed 1 Sept. 2023.

The Izotope Ozone 9 resonance remover was then used on the auxiliary track to remove the resonance from the digitised audio. The algorithm of the Izotope Ozone Neutron 3 resonance remover was able to automatically locate resonating frequencies of the digitised audio that were not naturally part of the sound of the instruments.

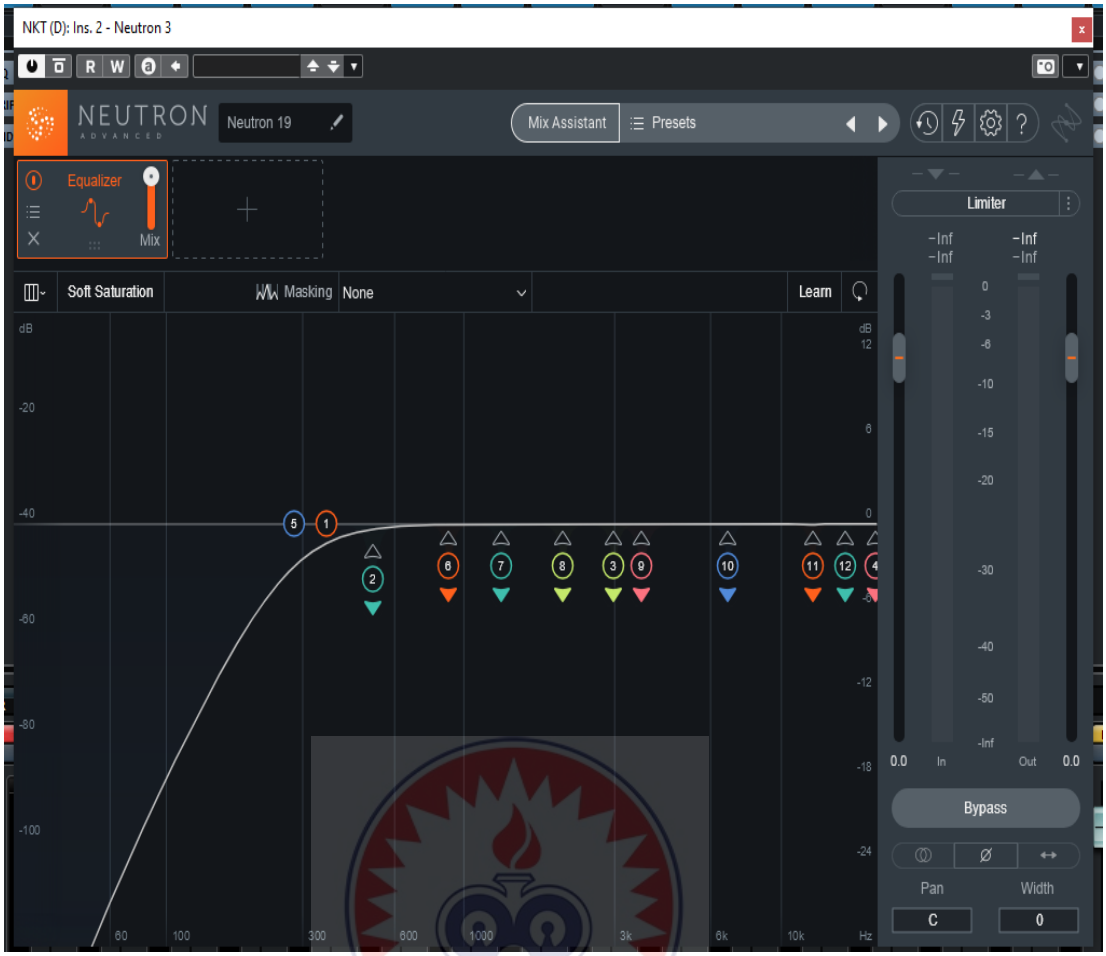


Figure 32: Izotope Neutron 3 Resonance Remover
Source: "Neutron 3 Features." *Neutron 3 Features*, www.izotope.com/en/products/neutron/features.html. Accessed 1 Sept. 2023.

Five supporting drum patterns at eighty (80) B.P.M were finally coded and exported as four (4) bars digitised loops into a folder named "Music Production" within the main database folder hosted on the desktop. Also, the *sakanadzo* variation of the master drum (*vuga*) at eighty (80) B.P.M was divided into seven (7) groups and coded as well as exported as digitised loops into the "Music Production" folder. Again, five (5) tones from the *tigo* instrument, five (5) from the *kretsiwa*, five from the *akaye,* seven (7) from the *asivui,* ten (10) from the *vuvi* and 16 from the *vuga* were coded and exported in the "Music Production" folder as digitised tones of *bɔbɔɔbɔ* instruments. These digitised audios are for music production, therefore they were exported at 48Hz and 24-bit to

maintain high sampling fidelity. The researcher avoided extensive processing of the digital audio with Virtual Studio Technologies Effect Plugins to give the end users the chance to further process the digitised audio according to their preference and the kind of music production outfit it may be used.

(b) Digitising the Sounds of Bɔbɔɔbɔ for music performance

As directed by the creative model, the researcher digitised the sounds of *bɔbɔɔbɔ* musical instruments for music performance on digital platforms. It was revealed that stakeholders need digitised audios of *bɔbɔɔbɔ* musical instruments loops that can be played on digital platforms for *bɔbɔɔbɔ* dance performances. The Klanghelm Volume Unit (VU) meter was used to regulate the amplitude of the recorded digital audio to the appropriate digital audio level void of clipping and noise. This was to ensure clean and clear digitised sounds.

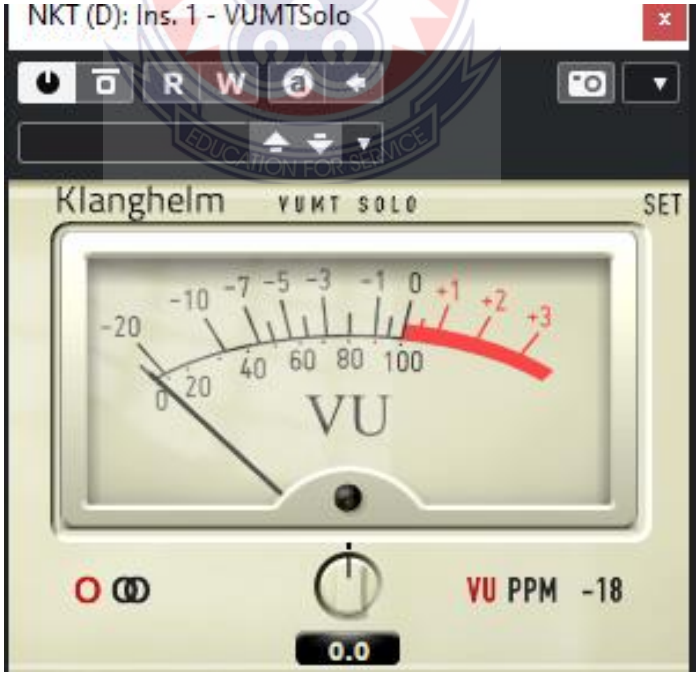


Figure 33: VU meter
Source: *Klanghelm*, klanghelm.com/contents/products/VUMT.html. Accessed 1 Sept. 2023.

The Izotope Ozone 9 resonance remover was as well used on the auxiliary track to remove the resonance from the digitised audios of *bɔbɔɔbɔ* musical instruments. The algorithm of the Izotope Ozone Neutron 3 resonance remover was able to automatically locate resonating frequencies of the digital audio that were not naturally part of the sound of the instruments.

Figure 34: Izotope Neutron 3 Resonance Remover
Source: "Neutron 3 Features." *Neutron 3 Features*, www.izotope.com/en/products/neutron/features.html. Accessed 1 Sept. 2023.

Also, to create an analogue summing effect for the digitized audios, the Waves Non-Linear Summing plugin was inserted at the final stereo output buss of the Cubase 11 DAW. This effect introduced compression and harmonic saturation to the sound of the digitised audio to make it sonically rich for use on any digital platform, speaker configuration and performance setting.

Figure 35: Waves Non-Linear Summing
Source: "Waves NLS Non-Linear Summer Plug-In." *Sweetwater*, www.sweetwater.com/store/detail/NLSNonLinSum--waves-nls-non-linear-summer-plug-in. Accessed 1 Sept. 2023.

Finally, since the digitised *bɔbɔɔbɔ* musical instrumental loops will be used by performers who may not have the technical competence to digitally manipulate these digital audio files, the researcher used a Solid State Logic (SSL) dynamic compressor to smooth out the dynamics of the loops. By using a ratio of 4:1, the researcher employed a gentle compression of 3dB of gain reduction. This ensured a related

dynamic range between the soft and loud parts of the *bɔbɔɔbɔ* musical instrumental loops.

Figure 36: Solid State Logic Compressor
Source: "Stereo Bus Compressor Module 500 Series - Solid State Logic." *500 Series | Solid State Logic*, www.solidstatelogic.com/products/stereo-bus-compressor-module. Accessed 1 Sept. 2023.

Five supporting drum patterns at eighty (80) B.P.M were digitised, coded and exported as loops into a folder named "Music Performance" within the main database folder

hosted on the desktop. Also, the *sakanadzo* variation of the master drum (*vuga*) at eighty (80) B.P.M was divided into seven (7) groups and coded as well as exported as loops into the "Music Performance" folder. Also, five (5) tones from the *tigo* instrument, five (5) tones from the *kretsiwa,* five (5) tones from the *akaye*, seven (7) tones from the *asivui,* ten (10) tones from the *vuvi* and 16 tones from the *vuga* were coded and exported in the "Music Performance" folder. These tones were created for various performers to upload into MIDI controllers and synthesizers for live performance. The researcher intentionally processed the digital audio with the NLS and SSL Virtual Studio Technologies Effect Plugins to organize the loops for a variety of performance applications on digital platforms.

(c) Digitising the sounds of Bɔbɔɔbɔ instruments for music composition

Again, the creative design fashioned how the researcher should digitally manipulate the sounds of *bɔbɔɔbɔ* musical instruments for music composition on digital platforms. It was discovered that the rhythms of *bɔbɔɔbɔ* musical instruments are needed for musical compositions in notation software programmes such as Sibelius and Finale. It was revealed that staff notation and MIDI packages of the rhythmic elements of *bɔbɔɔbɔ* musical instruments are sought after by stakeholders for music composition. The researcher, therefore, converted the samples digitised for music production into MIDI files and then extracted the rhythmic notation of the *bɔbɔɔbɔ* instrumental patterns from them.

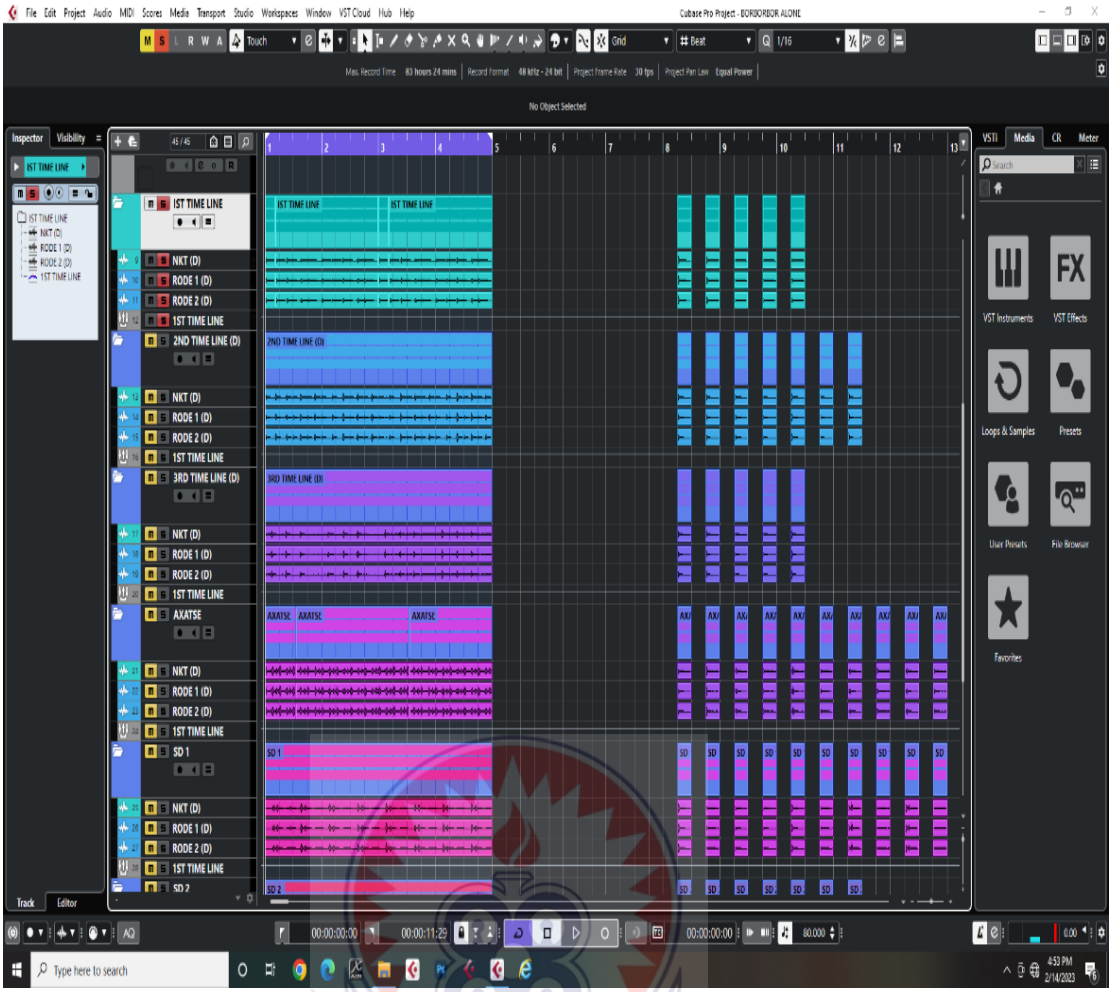


Figure 37: Cubase 11 Edit View

The digitised audios of *bɔbɔɔbɔ* instrumental patterns for music production were opened in Cubase 11 DAW edit view. The researcher right-clicked on the digitised audio file and selected the "Create MIDI Part from Audio Event" option. A MIDI part was created in the edit view and the researcher edited the MIDI rhythm to match the rhythm of the digital audio files. The next stage was to convert the MIDI files into notation. The researcher then selected the MIDI part and by right-clicking the "Convert to Notation" drop-down menu appeared. A dialog box appeared and the researcher adjusted the effectiveness of the conversion. After adjustment, the researcher clicked on "OK" and a notation view of the rhythmic patterns in *bɔbɔɔbɔ* instrumental setup was generated

in Cubase 11 DAW. The MIDI files were exported into a folder named "Music Composition" within the main database folder on the computer's desktop. The notation document was also saved as Extensible Markup Language (XML) and Portable Document Format (PDF) files in the same folder.

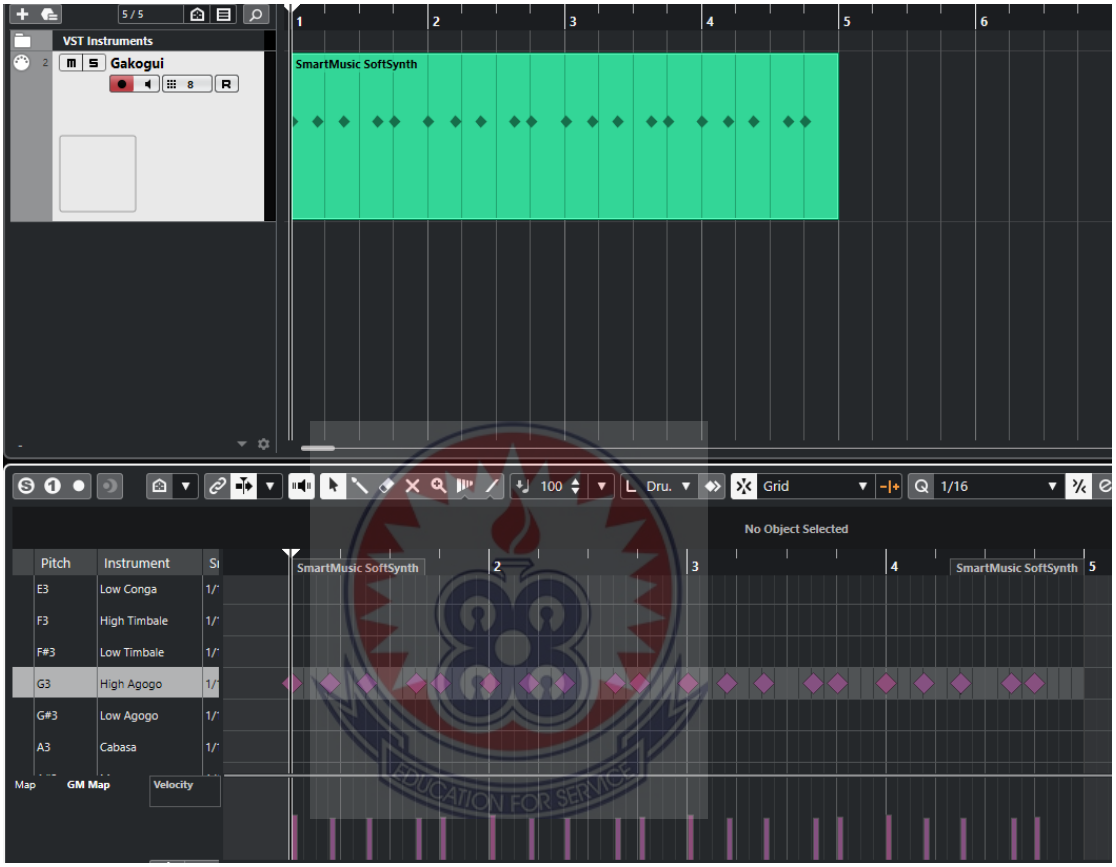


Figure 38: MIDI Rhythmic Pattern in Cubase 11 DAW

The digitised instrument sounds made up of loops, tone, MIDI and notations of *bɔbɔɔbɔ* instruments were all hosted in the desktop folder named database for digitised in *bɔbɔɔbɔ* instruments. The database was then subjected to a digitalisation process.

4.6 Database of *Bɔbɔɔbɔ* Musical Instruments.

Using the Two-Hand Steering Digital Platform Model and employing the creative design, a database was created for the sounds and visuals of *bɔbɔɔbɔ* musical instruments. The database involved digital pictures of *bɔbɔɔbɔ* musical instruments, pictures of instruments' positions, video lessons on how to play *bɔbɔɔbɔ* musical instruments, tones and loops of *bɔbɔɔbɔ* musical instruments for music production and performance as well as MIDI, staff notations and XML files of *bɔbɔɔbɔ* instrumental patterns for music composition.

4.6.1 Pictures of Bɔbɔɔbɔ Musical Instruments

(i) Gakogui

(ii) Gakogui Stick

(iii) Kretsiwa

(iv) Axatse

(v) Asivvvi

Side View

Top View

Top and Side View

(vi) Asivʊga

Side View *Top View* *Top and Side View*

(vii) Vʊga (A)

Side View *Top View* *Top and Side View*

(viii) Vvga (B)

Side View *Top View* *Top and Side View*

(ix) Vvga (C)

Side View *Top View* *Top and Side View*

Note that the *Vvga* (B) and (C) perform the same pattern as the *Vvga* (A) but in different pitches.

4.6.2 Pictures of Instrument's Playing Position

(i) Gakogui

(ii) Kretsiwa

(iii) Axatse

(iv) Asivvvi

(v) Asivvga

(vi) Vvvi

4.6.3 Video Lessons on How to Play Bɔbɔɔbɔ Musical Instruments

Using the Two-Hand Steering Digital Platform Model and employing the creative design, lessons to teach how to play *bɔbɔɔbɔ* musical instruments are presented in this section. After the preliminary lessons which teach the playing techniques, the subsequent lessons which teach how to play the instrumental patterns were prepared in two different tempos and categories. 60 beats per minute (BPM) deliver the instructional videos in a slow tempo which the learner can easily assimilate and 80 beats per minute (BPM) provide a regular real-time tempo for the learner to practice. Also, the instructional videos were presented in two kinds, one with a metronome and the other without a metronome.

4.6.3.1 Preliminary Video Lessons on Master Drum (vuga)Playing Techniques

(i) Bouncing

(ii) Flamming

(iii) Mute

(iv) Raised Mute

(v) Slapping

(vi) Spanking

4.6.3.2 60 BPM Video Lessons

(i) Gakogui Pattern Lesson

(ii) Kretsiwa Pattern Lesson

(iii) Axatse Pattern Lesson

(iv) Asivuga Pattern Lesson

(v)Asivuvi Pattern Lesson

(vi) Vuga Sakanadzo Pattern Lesson

Vuga Sakanadzo Pattern Lesson Segmented with Metronome (60BPM)

(i) Vuga Sakanadzo Pattern Lesson Part 1

(ii) Vuga Sakanadzo Pattern Lesson Part 2

(iii) Vuga Sakanadzo Pattern Lesson Part 3

(iv) Vuga Sakanadzo Pattern Lesson Part 4

(v) Ʋuga Sakanadzo Pattern Lesson Part 5 (vi) Ʋuga Sakanadzo Pattern Lesson Part 6


All these lessons were also prepared for practice but this time without a metronome to develop the learner's ability to maintain study and progressive metronome for effective performance. The individual instruments and the segmented master drum (*sakanadzo* variation) in 60 BPM were all recreated in this regard maintaining the same lesson structure.

4.6.3.3 80 BPM Video Lessons

(i) Gakogui Pattern Lesson *(ii) Kretsiwa Pattern Lesson*


(iii) Axatse Pattern Lesson

(iv) Asivuga Pattern Lesson

(v)Asivuvi Pattern Lesson

(vi) Vuga Sakanadzo Pattern Lesson

Vuga Sakanadzo Pattern Lesson Segmented with Metronome (80BPM)

(i) Vuga Sakanadzo Pattern Lesson Part 1 (ii) Vuga Sakanadzo Pattern Lesson Part 2

(iii) Ʊuga Sakanadzo Pattern Lesson Part 3 (iv) Ʊuga Sakanadzo Pattern Lesson Part 4


(v) Ʊuga Sakanadzo Pattern Lesson Part 5 (vi) Ʊuga Sakanadzo Pattern Lesson Part 6


All these lessons were also prepared for practice but this time without a metronome to develop the learner's ability to maintain study and progressive metronome for effective performance. The individual instruments and the segmented master drum (*sakanadzo* variation) in 80 BPM were all recreated in this regard maintaining the same lesson structure.

4.6.4 Tones and Loops of Bɔbɔɔbɔ Musical Instruments For Music Production

The tones and loops of *bɔbɔɔbɔ* musical instruments recorded and digitally manipulated for music production by using the creative design are presented in this section as part of the database for the sounds and visuals of *bɔbɔɔbɔ* of musical instruments to create the digital platform.

4.6.4.1 Tones of Bɔbɔɔbɔ of Musical Instruments for Music Production

The varieties of tones generated from the manipulation of the digital sounds were recorded using the creative design as established on the Two-Hand Steering Digital Platform Model. Using the techniques instituted through the reflexive practice, the varieties of sounds were extracted from the recorded sounds of *bɔbɔɔbɔ* musical instruments. These tones are presented below.

(i) Gakogui Tones

Gakogui Tone 1

Gakogui Tone 2

Gakogui Tone 3

Gakogui Tone 4

Gakogui Tone 5

(ii) Kretsiwa Tones

Kretsiwa Tone 1

Kretsiwa Tone 2

Kretsiwa Tone 3

Kretsiwa Tone 4

Kretsiwa Tone 5

(iii) Axatse

Axatse Tone 1

Axatse Tone 2

Axatse Tone 3

Axatse Tone 4

Axatse Tone 5

(iv) Asivuvi Tones

Asivuvi Tone 1

Asivuvi Tone 2

Asivuvi Tone 3

Asivuvi Tone 4

Asivuvi Tone 5

Asivuvi Tone 6

Asivuvi Tone 7

Asivuvi Tone 8

Asivuvi Tone 9

Asivuvi Tone 10

(v) Asivuga Tones

Asivuga Tone 1

Asivuga Tone 2

Asivuga Tone 3

Asivuga Tone 4

Asivuga Tone 5

Asivuga Tone 6

Asivuga Tone 7

(vi) Vuga Tones

Vuga Tone 1

Vuga Tone 2

Vuga Tone 3

Vuga Tone 4

Vuga Tone 5

Vuga Tone 6

Vuga Tone 7

Vuga Tone 8

Vuga Tone 9

Vuga Tone 10

Vuga Tone 11

Vuga Tone 12

Vuga Tone 13

Vuga Tone 14

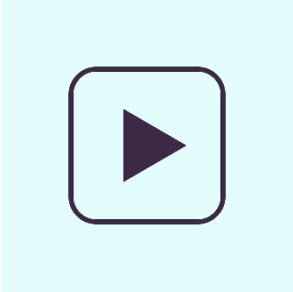
Vuga Tone 15

Vuga Tone 16

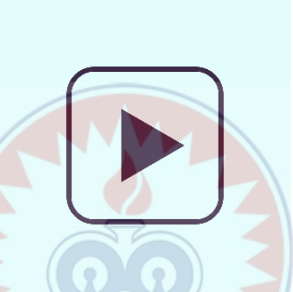
4.6.4.2 Loops of Bɔbɔɔbɔ of Musical Instruments For Music Production

The loops generated from the instrumental patterns recorded and digitally manipulated using the creative design as established on the Two-Hand Steering Digital Platform Model are presented in this section. Using the techniques instituted through the reflexive practice, instrumental loops were generated from the recorded and digitally manipulated sounds of *bɔbɔɔbɔ* musical instruments. These loops are presented below.

(i) Gakogui Loop

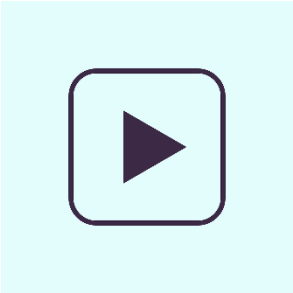


(ii) Kretsiwa Loop

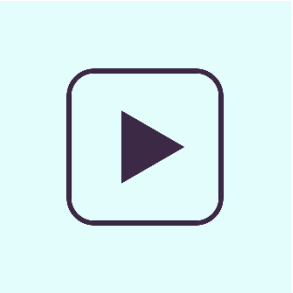


(iii) Axatse Loop

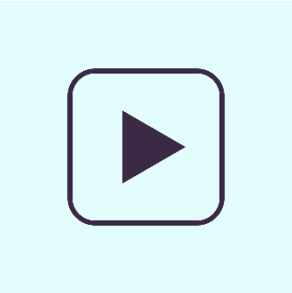
(iv) Asiʋuvi Loop



(v)Asiʋuga Loop



(vi) ʋuga Loop



Vuga Loop Segmented

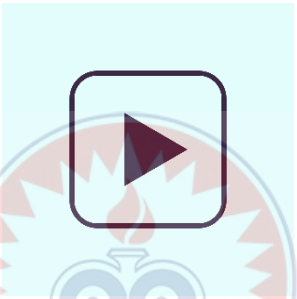
(i) Vuga Loop Part 1

(ii) Vuga Loop Part 2

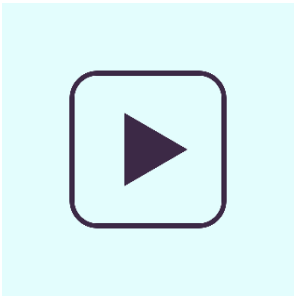
(iii) Vuga Loop Part 3

(iv) Vuga Loop Part 4

(v) Vuga Loop Part 5



(vi) Vuga Loop Part 6



(vii) Vuga Loop Part 7

4.6.5 Tones and Loops of Bɔbɔɔbɔ Musical Instruments For Music Performance

As part of the database for the sounds and visuals of *bɔbɔɔbɔ* musical instruments to create the digital platform, the tones and loops of *bɔbɔɔbɔ* musical instruments recorded and digitally manipulated for music performance are presented in this section.

4.6.5.1 Tones of Bɔbɔɔbɔ of Musical Instruments for Music Performance

The varieties of tones generated from the manipulation of the digital sounds were recorded using the creative design as established on the Two-Hand Steering Digital Platform Model. Using the techniques instituted through the reflexive practice, the varieties of sounds were extracted from the recorded sounds of *bɔbɔɔbɔ* musical instruments. These tones are presented below.

(i) Gakogui Tones

Gakogui Tone 1

Gakogui Tone 2

Gakogui Tone 3

Gakogui Tone 4

Gakogui Tone 5

(ii) Kretsiwa Tones

Kretsiwa Tone 1

Kretsiwa Tone 2

Kretsiwa Tone 3

Kretsiwa Tone 4

Kretsiwa Tone 5

(iii) Axatse

Axatse Tone 1

Axatse Tone 2

Axatse Tone 3

Axatse Tone 4

Axatse Tone 5

(iv) Asivuvi Tones

Asivuvi Tone 1

Asivuvi Tone 2

Asivuvi Tone 3

Asivuvi Tone 4

Asivuvi Tone 5

Asivuvi Tone 6

Asivuvi Tone 7

Asivuvi Tone 8

Asivuvi Tone 9

Asivuvi Tone 10

(v) Asivuga Tones

Asivuga Tone 1

Asivuga Tone 2

Asivuga Tone 3

Asivuga Tone 4

Asivuga Tone 5

Asivuga Tone 6

Asivuga Tone 7

(vi) Vuga Tones

Vuga Tone 1

Vuga Tone 2

Vuga Tone 3

Vuga Tone 4

Vuga Tone 5

Vuga Tone 6

Vuga Tone 7

Vuga Tone 8

Vuga Tone 9

Vuga Tone 10

Vuga Tone 11

Vuga Tone 12

Vuga Tone 13

Vuga Tone 14

Vuga Tone 15

Vuga Tone 16

4.6.5.2 Loops of Bɔbɔɔbɔ of Musical Instruments for Music Performance

The loops generated from the instrumental patterns recorded and digitally manipulated using the creative design as established on the Two-Hand Steering Digital Platform Model are presented in this section. Using the techniques instituted through the reflexive practice, instrumental loops were generated from the recorded and digitally manipulated sounds of *bɔbɔɔbɔ* musical instruments. These loops are presented below.

(i) Gakogui Loop

(ii) Kretsiwa Loop

(iii) Axatse Loop

(iv) Asiʋuvi Loop

(v)Asiʋuga Loop

(vi) ʋuga Loop

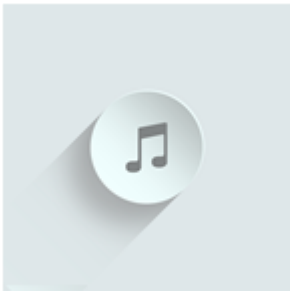
Vuga Loop Segmented

(i) Vuga Loop Part 1

(ii) Vuga Loop Part 2

(iii) Vuga Loop Part 3

(iv) Vuga Loop Part 4



(v) Vuga Loop Part 5

(vi) Vuga Loop Part 6

(vii) Vuga Loop Part 7

4.6.6 MIDI, Staff Notations and XML Files of Bɔbɔɔbɔ Instrumental Patterns

The MIDI patterns and staff notations of *bɔbɔɔbɔ* instrumental patterns were digitally generated by converting the digitally recorded loops for music production first into MIDI patterns in Cubase 11 Daw and then converting the MIDI patterns into staff notations in the same DAW. This process was also directed by the creative design which was established on the Two-hand Steering Digital Platform Model.

4.6.6.1 MIDI Patterns of Bɔbɔɔbɔ Instrumental Patterns

(i) Gakogui

(ii) Kretsiwa

(iii) Axatse

(iv) Asiʋuvi

(v)Asiʋuga

(vi) ʋuga

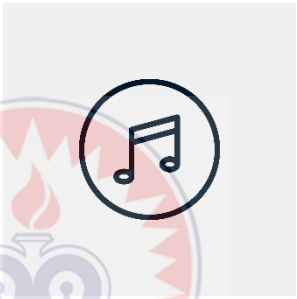
Vuga MIDI Pattern Segmented

(i) Vuga MIDI Pattern Part 1

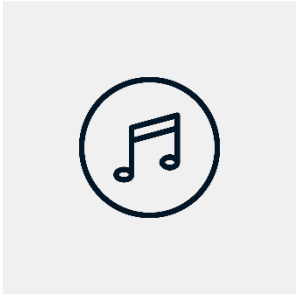
(i) Vuga MIDI Pattern Part 2

(i) Vuga MIDI Pattern Part 3

(i) Vuga MIDI Pattern Part 4



(i) Vuga MIDI Pattern Part 5



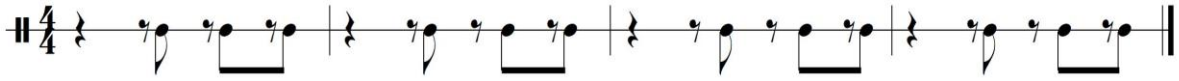
(i) Vuga MIDI Pattern Part 6

(i) Vuga MIDI Pattern Part 7

4.6.6.2 Staff Notation of Bɔbɔɔbɔ Instrumental Patterns

(i) Gakogui

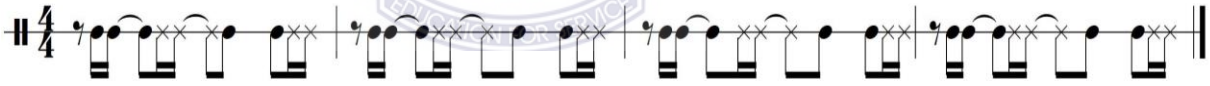
(ii) Kretsiwa



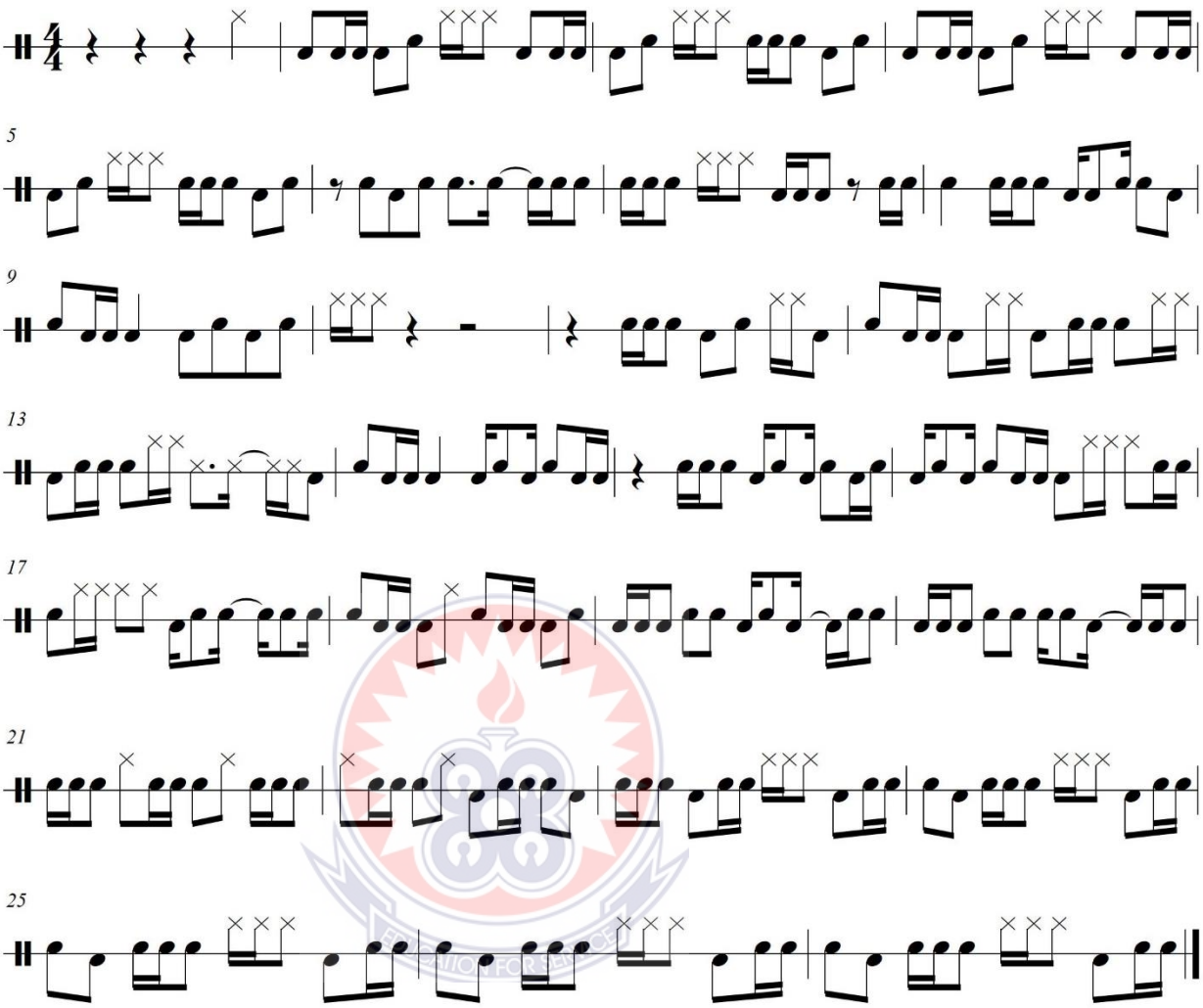
(iii) Axatse

(iv) Asivuvi

(v)Asivuga

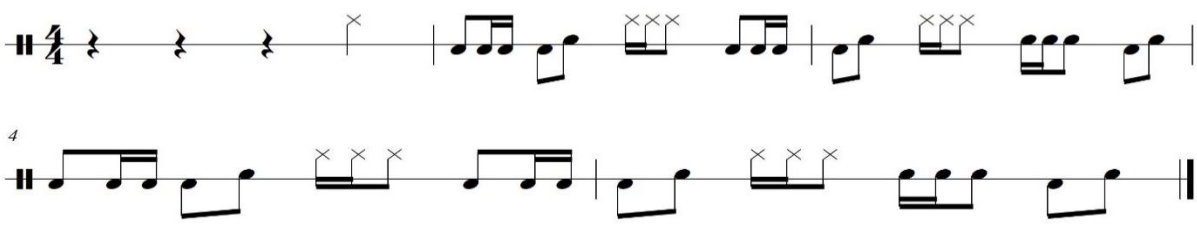


(vi) Vuga Sakanodzo Variation

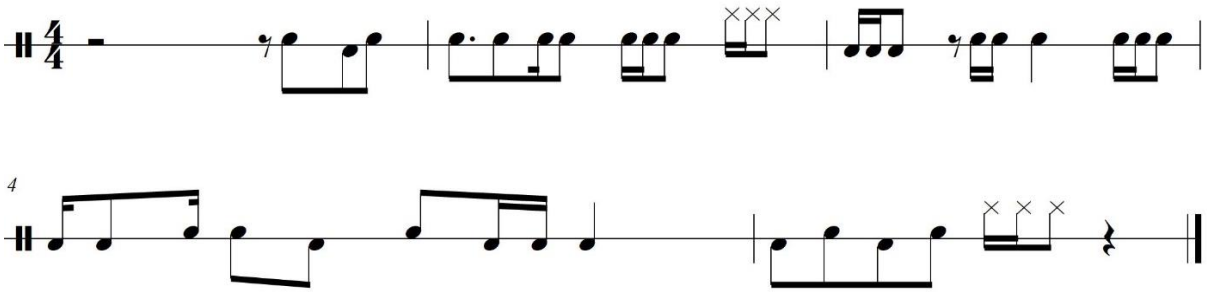


Vuga Sakanadzo Segmented

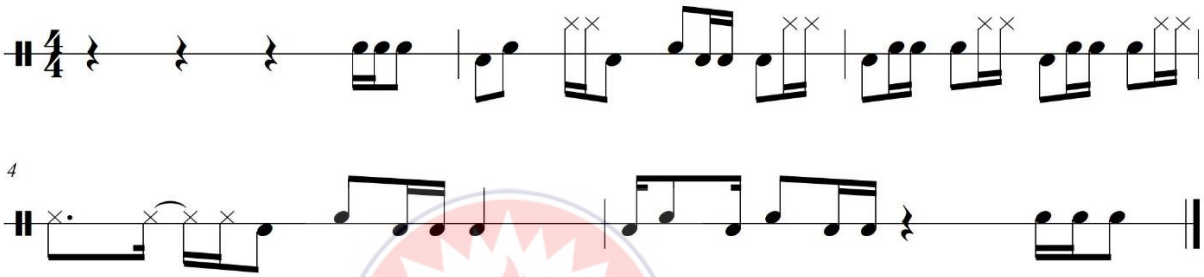
(i)Vuga Part 1



(ii)Vuga Part 2

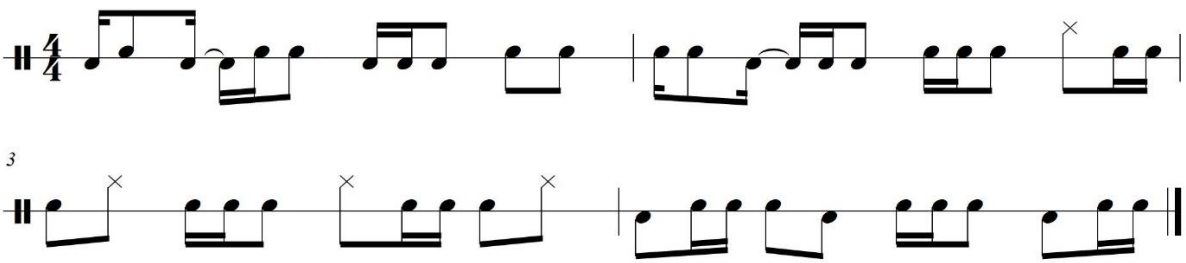


(iii)Vuga Part 3

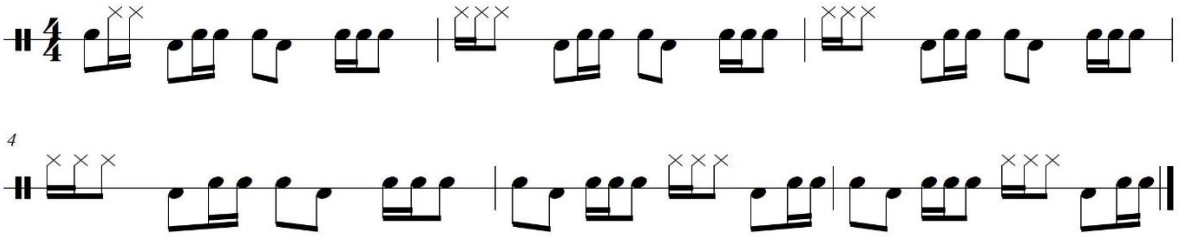


(iv)Vuga Part 4

(v)Vuga Part 5



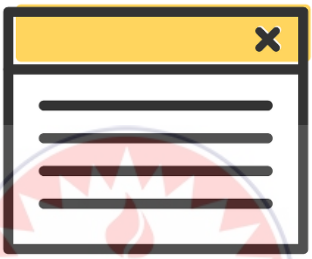
(vi)Vuga Part 6



4.6.6.3 XML Bɔbɔɔbɔ Instrumental Patterns

(i) Gakogui

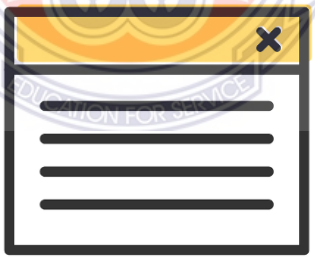
(ii) Kretsiwa



(iii) Axatse

(iv) Asivuvi

(v)Asivuga



(vi) Vuga Sakanodzo

Vuga Sakanadzo Segmented

(i)Vuga Part 1

(ii)Vuga Part 2

(iii)Vuga Part 3

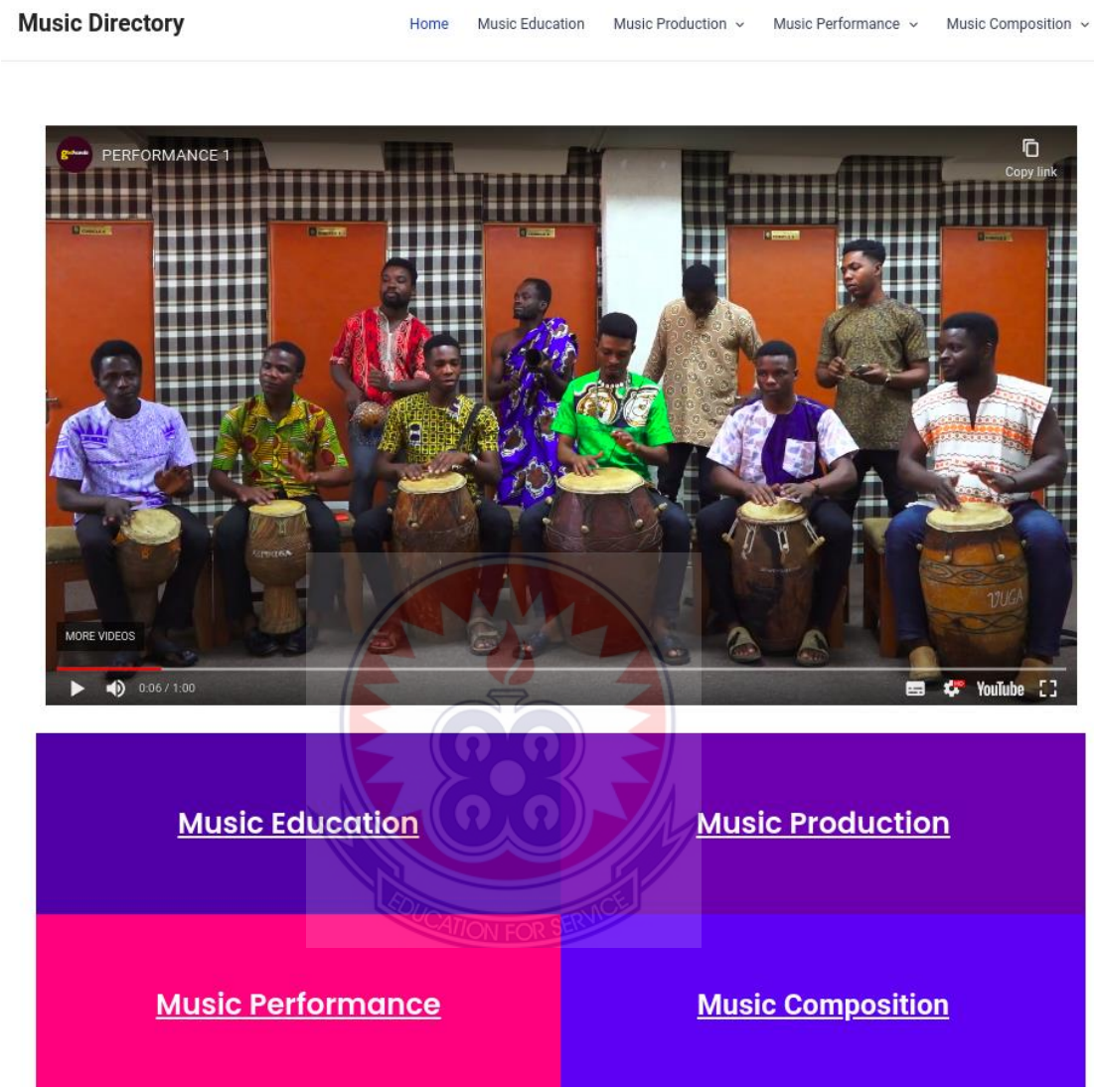
(iv)vuga Part 4

(v)vuga Part 5

(vi)vuga Part 6

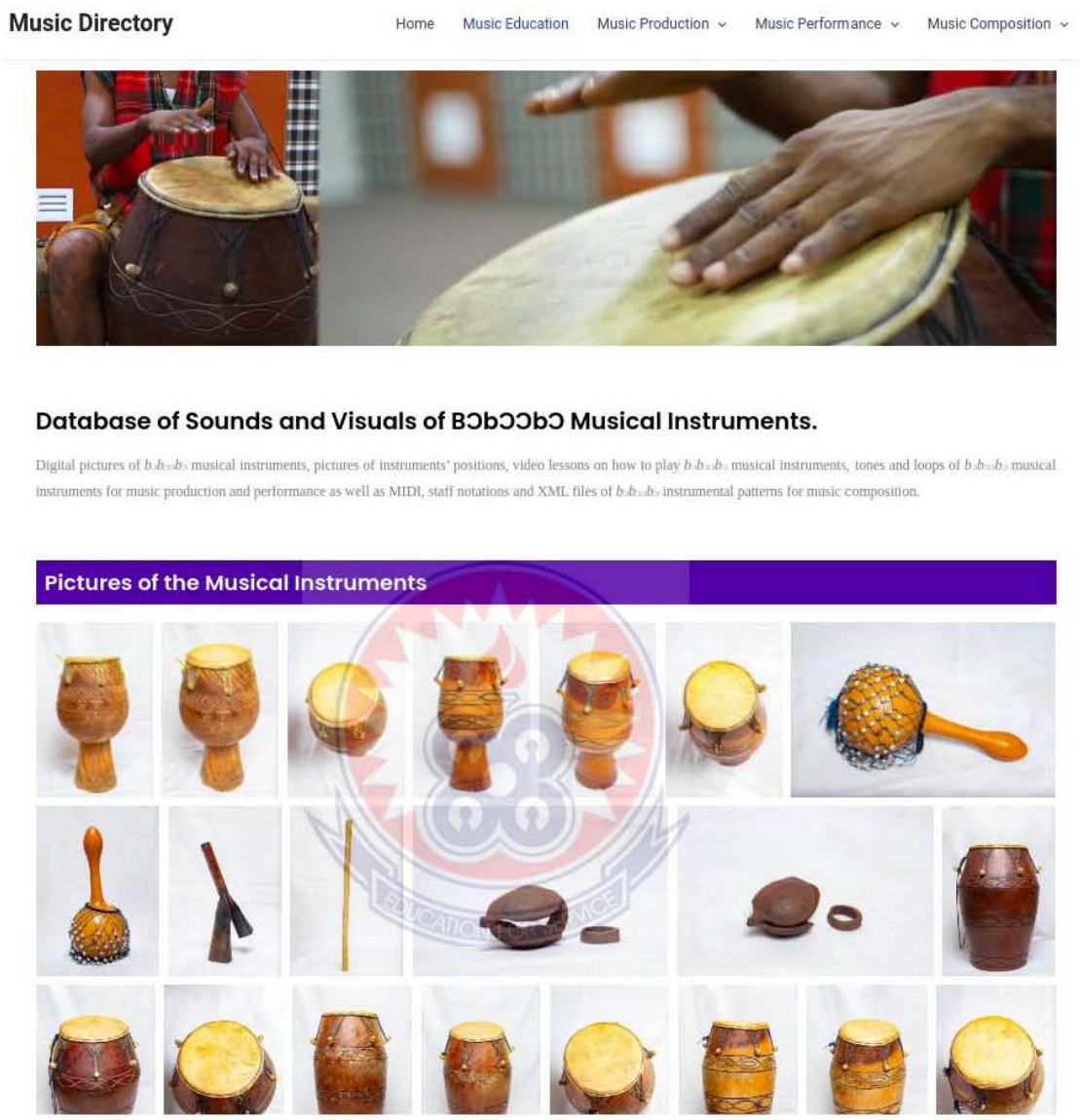
CHAPTER FIVE

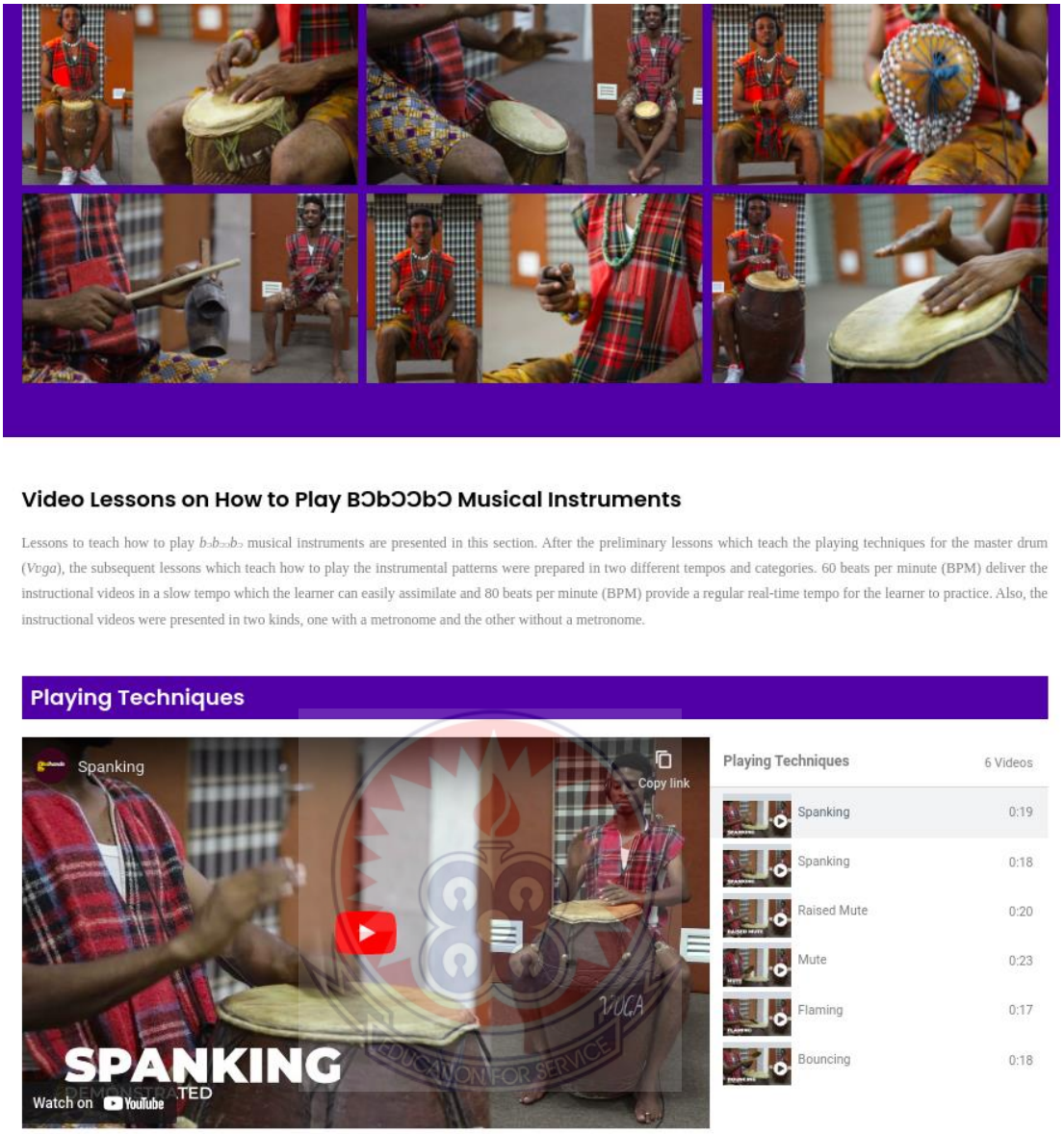
BƆBƆƆBƆ DIGITAL WEBSITE



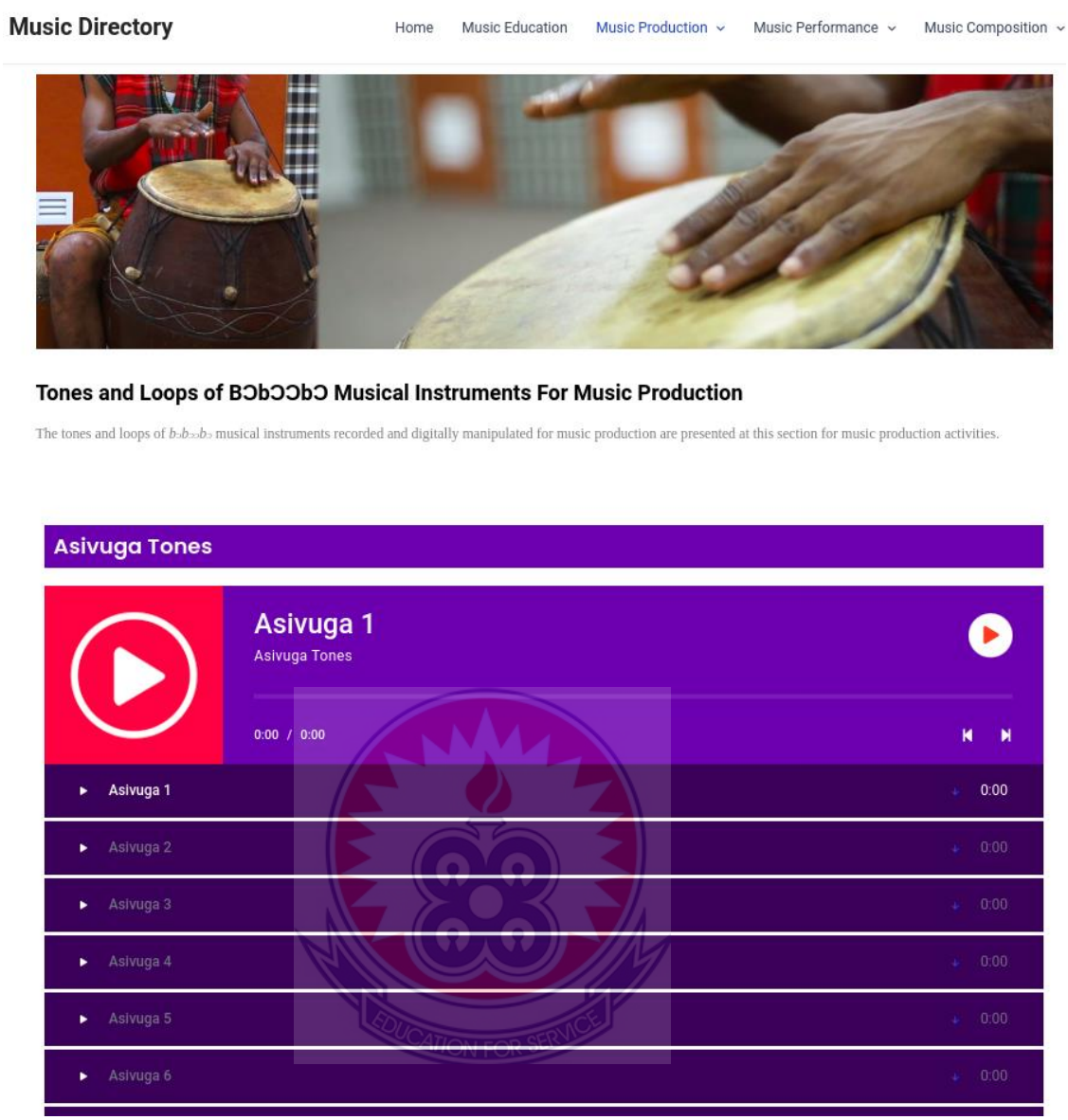
The picture above is the home page of the website for the sounds and visuals of *bɔbɔɔbɔ* musical instruments for musical activities on digital platforms. When the website is navigated via a search engine, the first page to see is the home page therefore the home page was made attractive by featuring a short *bɔbɔɔbɔ* instrumental ensemble which plays automatically as the page is opened. On the home page, the four activities that may be carried out on the digital platform are also clearly displayed. The activities are

listed on the menu bar and at the same time prominently highlighted in different colours on the homepage.

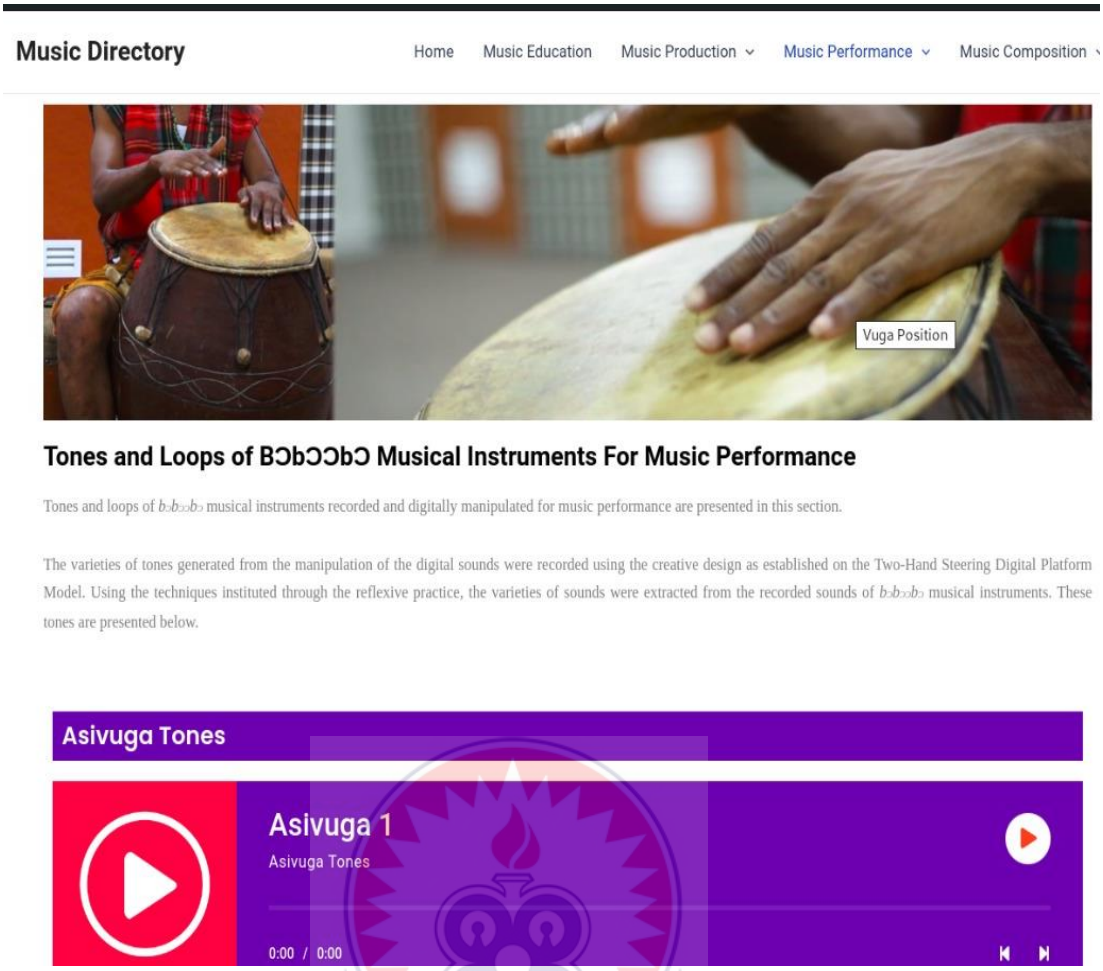




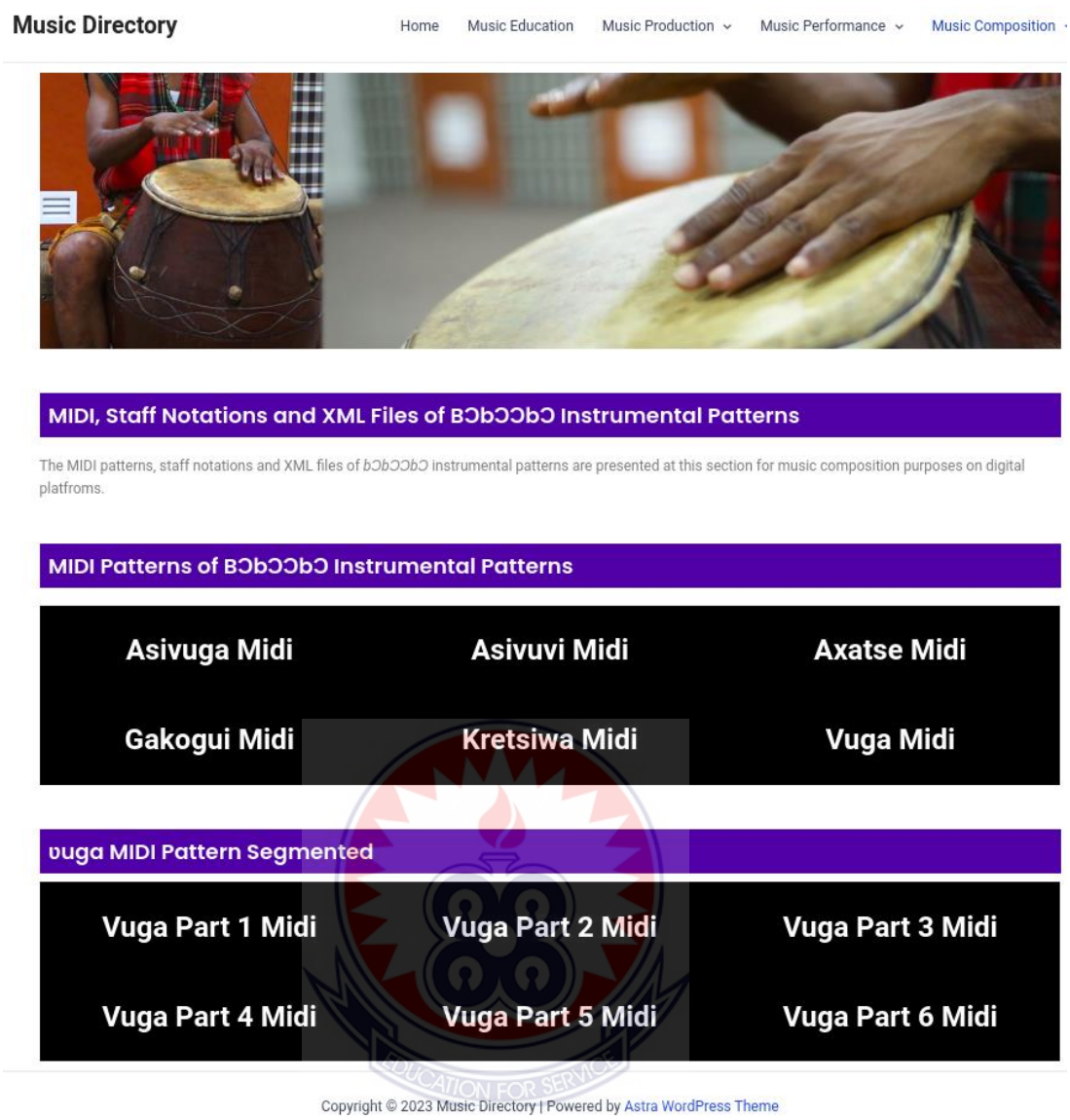
The two pictures above display some audio-visuals and visuals created for the Music Education activities. Clicking “Music Education” on the menu bar or from the boldly displayed activities on the home page leads to audio-visuals and visuals that music educators and students can explore and download to teach and study the nature of *bɔbɔɔbɔ* musical instruments, instruments playing positions, playing techniques and how to play the instrumental patterns.



The picture above shows some of the sounds of *bɔbɔɔbɔ* musical instruments created for "Music Production". Clicking "Music Production" on the menu bar or from the boldly displayed activities on the home page leads to tones and loops which music producers can explore or download into VSTi's, DAWs and mobile applications for music production activities.



The picture above shows some of the sounds of *bɔbɔɔbɔ* musical instruments created for "Music Performance". Clicking "Music Performance" on the menu bar or from the boldly displayed activities on the home page leads to tones and loops which music performers such as *bɔbɔɔbɔ* dancers can explore or download into music players, VSTi's, DAWs and mobile applications for music performance activities.



The picture above shows some of the MIDI files, XLM files and notations of *bɔbɔɔbɔ* instrumental patterns created for "Music Composition". Clicking "Music Composition" on the menu bar or from the boldly displayed activities on the home page leads to MIDI files, XLM files and notations of *bɔbɔɔbɔ* instrumental patterns that music composers can import into notation software programmes such as Finale and Sibelius for music composition activities.

5.2 Analysis of the website

The realisation of the sounds, visuals, MIDI, XLM and notations on the website as well as the features of the website created establishes a novel digital platform model created with conscious cognition, effective methodology and effective practice to position the sounds and visuals of *bɔbɔɔbɔ* musical instruments for musical activities on digital platforms. It is obvious that the website's innovative features and content could not have originated from previous digital platform models for Ghanaian traditional musical elements. The theories and the designs upon which the newly created model operated reflected in the functions of the website as various musical needs for the sounds and visuals of *bɔbɔɔbɔ* musical instruments can be resolved on the website. Indeed, the website is an epitome of deliberate cognition, effective methodology and effective practice to transport the sounds and visuals of *bɔbɔɔbɔ* musical instruments onto digital platforms for musical activities. The efficiency of this website can only be traced to the Two-Hand Steering Digital Platform Model.

Also, the nature of the contents on the website and the way they have been organised is unusual of websites created for the sounds and visuals of Ghanaian traditional musical elements. The sounds and visual quality and features justifies the mindful effort to respond to the direct needs of stake holders who wanted to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms for music education, production, performance and composition. This attribute of the website can only be linked to the initiative prescribed by the Two-Hand Steering Digital Platform Model which entreated the developer of the website to find out how stakeholders wanted to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms.

Also, the quality of sounds and visuals and the way they translate on the website signify the practical and cognitive investment instituted by reflexively exploring equipment and techniques. Moreover, the WordPress template which the website was structured upon provided comprehensive and simple to navigate interface. The website can achieve maximum efficiency among stakeholders who want to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms for music education, production, performance and composition. The status of music educators who engage this website will be transformed as they can easily conduct *bɔbɔɔbɔ* drumming lessons without restrictions of location and time. Music students as well can easily learn how to play the instrumental patterns of *bɔbɔɔbɔ* musical instruments with little guidance without restriction of location and time. Music producers who do not have the luxury of facilities and the equipment to record the sounds of *bɔbɔɔbɔ* musical instruments for music production purposes can simply go to the "Music Production" menu on the website to explore and also download loops and tones of *bɔbɔɔbɔ* musical instruments for music production. Furthermore, music performers can visit the website and navigate to the "Music Production" section to explore the loops and tones of *bɔbɔɔbɔ* musical instruments for music performance purposes. Lastly, music composers do not have to worry themselves trying to notate the complex rhythmic patterns of the master drum of *bɔbɔɔbɔ* ensembles. They can easily visit the website to download the MIDI, XML and notations of the *sakanadzo* master drum pattern of *bɔbɔɔbɔ* musical instruments as well as the supporting drum patterns for music composition in music notation software programmes. The link to the website is presented below for stakeholders to explore.

https://ayesu.brandafro.com/music-education/

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.0 Preamble

This chapterincludes a summary of the study's main findings as well as any other inferences that could be made from them. It also offers recommendations based on the conclusions reached, as well as suggests some areas to consider in future studies, to help or inspire music researchers and ethnomusicologists to enlarge the boundaries of digital platforms for traditional musical elements in the setting of Africa.

6.1 Summary

The goal of this study was to expand the field of literature surrounding digital platforms for Ghanaian traditional musical elements by exploring the essential practices that drive the sounds and visuals of traditional musical elements onto digital platforms. The intention was to create a novel digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments which is culturally contextualized and distinctly African. The lack of such digital platforms, as opposed to the growth and development of digital possibilities and its relations to the sounds and visuals of traditional musical instruments, served as the impetus for the aforementioned intentions. Possibly the lack of such digital platforms is a result of the complexity of the process of coordinating methodologies within the right technological situation to create such platforms. In this sense, the study explored ideas that brought concepts together to build a conceptual model for creating digital platforms for sounds and visuals of Ghanaian traditional musical instruments, which was grounded on the uses and gratification theory, interdisciplinary theory and the technological acceptance model. The study design

involved bibliographic design, discographic design and idiosyncratic applied ethnographic design which allowed for the use of interviews, studio–based design and creative designs to gather the data and create the digital platforms. In accordance with the first study question, which attempted to construct and develop a model for creating digital platforms for the sounds and visuals of Ghanaian traditional musical instruments, a model for a digital platform has been created – Two - Hand Steering Digital Platform Model – and this model provides the procedure for developing digital platforms for the sounds and visuals of Ghanaian traditional musical instruments within the African setting. This model was conceptualized and established as a digital platform model for sounds and visuals of Ghanaian traditional musical instruments through the analysis of the relevant literature.

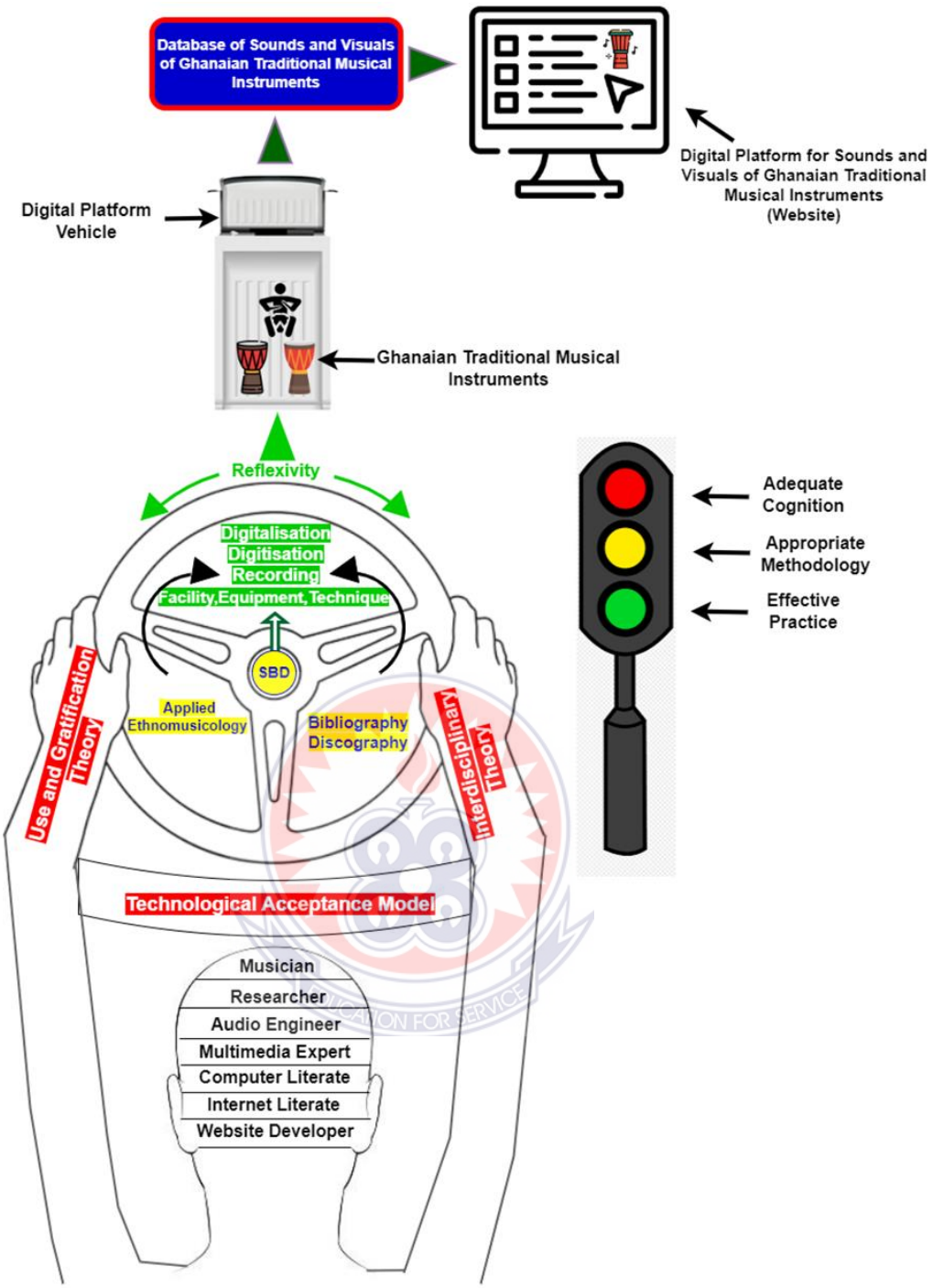


Figure 39: Two-Hand Steering Digital Platform Model (S.N.Ayesu, 2023)

In accordance with the model, the second question the study mounted explored how stakeholders wanted to use sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms to also direct the creation of the digital platform. The study, therefore,

explored how a music educator, music student, music producer, music performer and music composer wanted to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms. The study recognised contemporary ways stakeholders wanted to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms. Side-view, top-view and top and side view of pictures of *bɔbɔɔbɔ* musical instruments as well as serialized sounds and visuals of *bɔbɔɔbɔ* musical instruments in slow tempo for learning purposes and moderate tempo for rehearsal purposes were needed. These sounds and visuals are needed both online and offline to escape the restrictions of internet connectivity. Also, downloadable videos of the sounds and visuals of *bɔbɔɔbɔ* musical instruments on websites were needed for students to download and keep them as part of their learning materials during an examination. It was recognised that graduate students who completed the 4-year music programme and are posted to junior high and senior high schools wanted the sounds and visuals of *bɔbɔɔbɔ* musical instruments as a companion to their teaching fields. In this sense, they also want a digital platform that will allow the downloading of the sounds and visuals of *bɔbɔɔbɔ* musical instruments. Moreover, the tones and loops of the sounds of *bɔbɔɔbɔ* musical instruments are needed by music producers on digital platforms. Music producers want to download and import the tones and loops of *bɔbɔɔbɔ* musical instruments into VSTi and edit windows of DAW respectively. They want varieties of tones of *bɔbɔɔbɔ* musical instruments to be imported and uploaded in VSTi such as Battery 4 VSTi and Kontakt 5 so that they can use MIDI configurations with MIDI keyboards to trigger the sounds of *bɔbɔɔbɔ* musical instruments. Also, with the help of the time-stretch possibilities in most DAW music producers want to import the loops of *bɔbɔɔbɔ* instrumental patterns into the edit windows and time-stretch them for various musical tempos and styles. Similarly, music performers want the loops of *bɔbɔɔbɔ* instrumental

patterns as an alternative to the absence of *bɔbɔɔbɔ* drummers. They want digital audio files of well recorded *bɔbɔɔbɔ* musical instruments patterns on phones and laptops as part of their resources during a performance. Moreover, since they do not always get *bɔbɔɔbɔ* drummers during rehearsals, music performers want the loops of both the master drums and the master drum variations for rehearsal purposes. Again, they want relaxation and flexibility in choreographing dance movements in *bɔbɔɔbɔ* dance without the intimidation of drummers who may find the process stressful, therefore using the instrumental loops of *bɔbɔɔbɔ* musical instruments, they can manipulate with reflexivity until their choreographic objectives are achieved. With all these user objectives, music performers want the loops of *bɔbɔɔbɔ* instrumental patterns on a website platform which can be accessed and also downloaded for their musical activities. Music composers on the other hand expressed their delight to import MIDI packs of *bɔbɔɔbɔ* instrumental patterns into music notation software programmes like Finale and Sibelius. They especially want to use the master drum variations of *bɔbɔɔbɔ* instrumental patterns in their orchestration in music notation software programmes. Moreover, they want the patterns of *bɔbɔɔbɔ* musical instruments in XML files to be able to import not only into music notation software programmes but also DAWs for compositional purposes. With this in mind, they want a website platform where they can access both MIDI and XML files of *bɔbɔɔbɔ* musical instruments patterns.

Likewise, in line with the Two-hand Steering Digital Platform model, the third research question explored how appropriate facilities and features of equipment can be used to record and digitise the sounds and visuals of *bɔbɔɔbɔ* musical instruments. The audio - Visual facility based in the Department of Music Education based on the Two Hand Steering Digital Platform Model qualified to be used to record and digitise the sounds

and visuals of *bɔbɔɔbɔ* musical instruments. It was an acoustically treated space with minimal resonance and prevented unnecessary reverberations. The space contributed to preserving the most natural sonic and visual features of the sounds and visuals of *bɔbɔɔbɔ* instruments. The space unlike the other studio facilities had an acoustic ceiling and thick woolen carpet which help to reduce the reflection of sound. Also, the space was well-lit with adequate square LED downlights that contribute to good photography and videography. Again, the Two-Hand Steering Digital Platform Model oriented the selection of appropriate features of equipment for the recording and digitisation of the sounds and visuals of *bɔbɔɔbɔ* musical instruments. As expected from the creative design, one Midas M32 Digital Mixer Board, three Rode NT2-A condenser microphones, one Rode NTK large-diaphragm tube condenser microphone, a pair of Yamaha HS8 W 8-Inch Powered Studio Monitor Speakers, one AKG K72 Closed-Back Studio Headphones, three Audio-Technica ATH-M50X, six microphone stands, one HP Desktop Pro G2 Microtower PC - Core i5-8400 / 4GB RAM / 1TB HDD and Steinberg Cubase 11 Digital Audio Workstation with VSTi's were selected for digital audio recording and manipulation of the sounds of *bɔbɔɔbɔ* musical instruments. Likewise, the visual equipment selected based on the Two-Hand Steering Digital Platform Model were one Canon EOS 6D Mark II DSLR Camera, one Canon EF 50mm f/1.4 USM Prime Lens, one PXW-Z190 Handheld Camcorder - 4K HDR, one DJI RSC 2 Gimbal Stabilizer Pro Combo, one tripod stand, two 64-gigabyte memory, Adobe Photoshop 2020 and Adobe Premiere Pro 2020.

In the same way, the fourth research question explored appropriate audio and visual techniques that can be used to digitise and manipulate the sounds and visuals of *bɔbɔɔbɔ*

musical instruments. Established on the Two - Hand Steering Digital Platform Model, audio recording and digitisation setup and visual recording and digitisation setup were discovered and used for the recording and digitisation of the sounds and visuals of *bɔbɔɔbɔ* musical. The audio recording and digitisation configuration used involved a project studio setup with digital equipment and a microphone to convert mechanical sounds into electrical signals and also to convert the electrical signal into digital format on the computer.

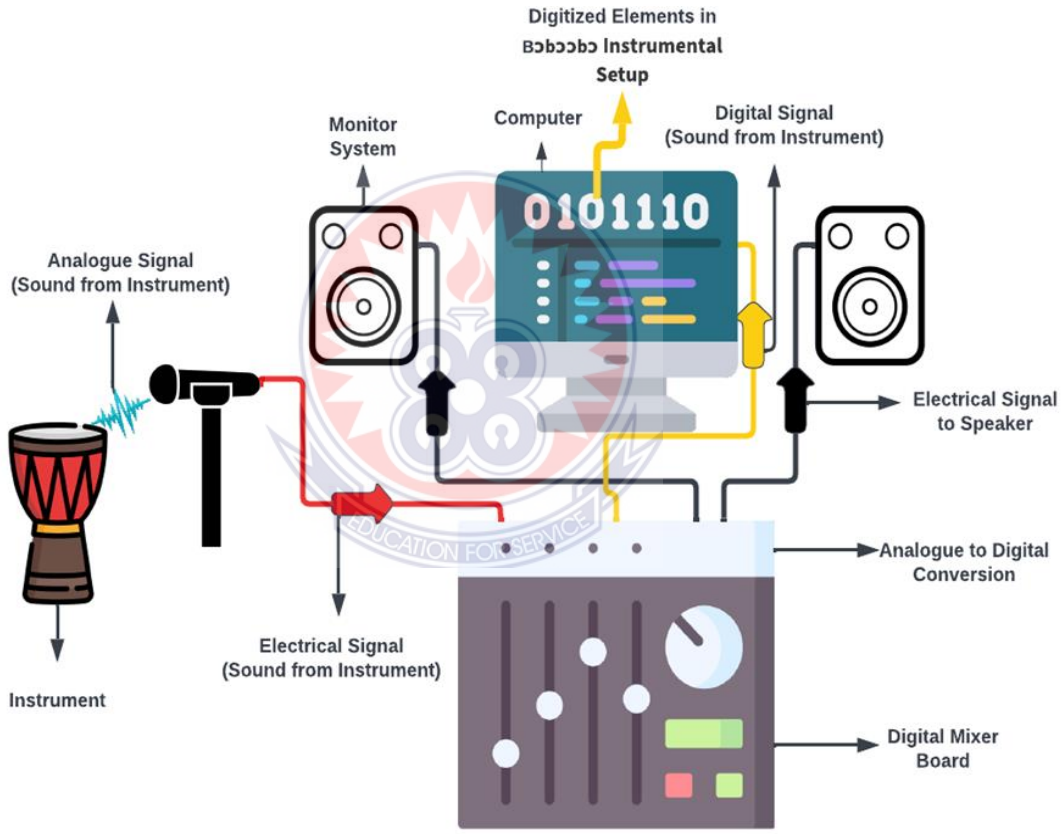


Figure 40: Audio Recording and Digitisation Setup

The visual recording and digitisation configuration used visual recording and editing setup with digital equipment to take images and record video, editing and storing visuals of *bɔbɔɔbɔ* musical instruments.

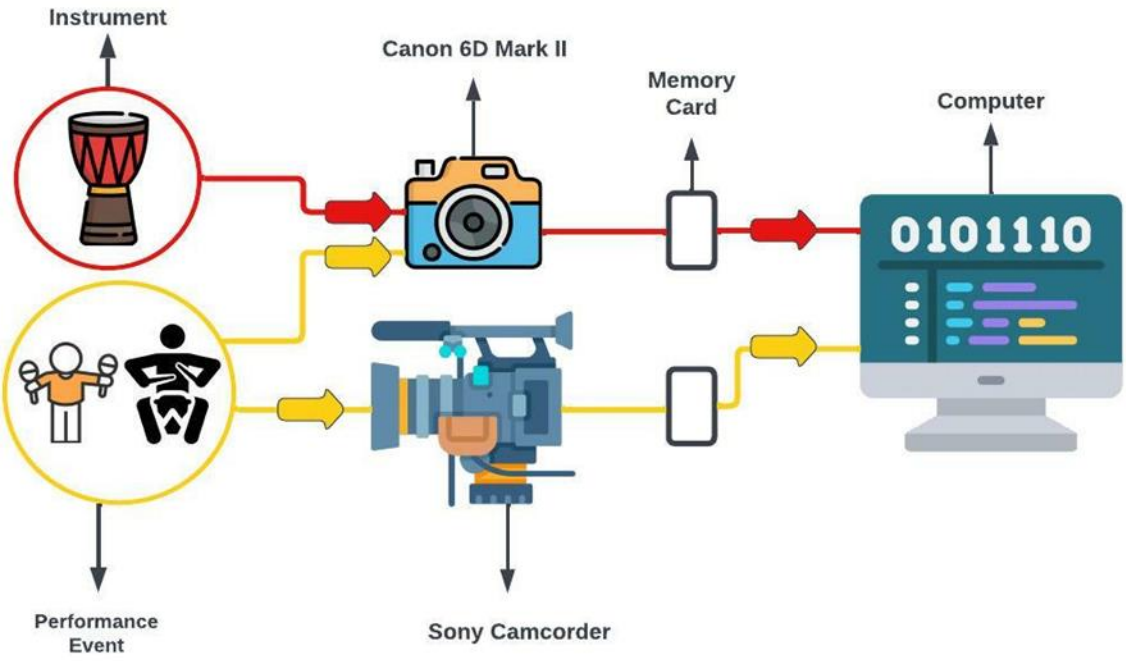


Figure 41: Visual Recording Setup

The techniques discovered for the recording and digitisation of the sounds and visuals of *bɔbɔɔbɔ* musical instruments were based on these two setup configurations which were also based on the Two - Hand Steering Digital Platform Model. Recording and digitizing the sounds and visuals of *bɔbɔɔbɔ* musical instruments for music education, techniques discovered for taking images of *bɔbɔɔbɔ* musical instruments involved maintaining a significant distance proportional to the size of the instrument, taking side view, top view and top and side view pictures of the musical instruments and uploading pictures into Adobe Photoshop for editing. Editing involved cropping the image background off and giving the images white backgrounds for learners to easily look at them for a long time and also focus on the subject with ease. Also employing blur and sharpening tools helped the focus of the images. It was as well discovered that saturation and colour balance tools in Adobe Photoshop can be used to balance the image of dry and corrosive instruments to make them look attractive before exporting

them into the database folder. On the other hand, the videos created for the drumming lessons involved visual recording techniques such as two perspective recordings with one close focus on hand and leg reactions with instruments and the other focus on the performer and the instruments. Conon 6D Mark II was used for close focus and Sony PXW-Z190 Camcorder was used for the wide perspective. It was revealed that wide perspective captures the performer's position, body movement, instrument position and performer's antiques as close focus shots provided a close perspective that focuses on how the performer's hand and legs react with the instrument. Another key point discovered was that the digital sounds from the cameras were limited in terms of representing the complete sonic attributes of the instrument's sounds therefore spaced pair microphone technique which is a stereo microphone configuration can be used to record and maintain the sonic attributes of the musical instruments. In that sense, the sound recorded by the video camera as part of the video recording was replaced by the spaced-pair microphone configuration sounds. The instructional videos were prepared at a slow tempo (60 BPM) which the learner can easily imitate and also at a regular real-time tempo (80 BPM) for the learner to practice. Additionally, the study revealed that the sounds of *bɔbɔɔbɔ* musical instruments for music production and performance can be recorded with a project-studio setup using the mid-side microphone technique. It was evident through the reflexive practice that the mid-side microphone technique was best at representing the attributes of the musical instruments. After digitally recording the instruments, the Klanghelm VU meter plugin was used to ensure optimum signal level. Izotope Neutron 3 Resonance Remover plugin was used to reduce resonance which was part of the digitally recorded sound. To make the sounds more organic, the Waves non-linear summing plugin was used for harmonic saturation. Also, the Solid State Logic Compressor plugin was used to control the dynamics of the sounds

recorded. After digitally manipulating the sounds of the recorded *bɔbɔɔbɔ* musical instruments, six instrumental loops were exported into the database for the website these included four bars loops of *akaye*, *tigo*, *kretsiwa*, *asivui*, *vuvi* and one complete *vuga* variation. The vuga variation was further segmented into seven sections. Moreover, fourty eight varieties of tones were generated from the various musical instruments. After these processes as directed by the model, the tones and loops were in the required specification to be uploaded to a website platform for music production and performance purposes. Note that the tones and loops for music production purposes were flexibly processed to create room for music producers to further process these tones for various production settings however, the tones and loops for music performance were adequately processed for use in various performance settings. As well, the instrumental loops and the *vuga* segments were converted in Cubase 11 DAW into MIDI and XML files for music compositional purposes in music notation software programmes like Finale 12 and Sibelius. On the whole, pictures, videos, tones and loops of *bɔbɔɔbɔ* musical instruments were recorded and digitally manipulated and a database was developed or the creation of the website for the sounds and visuals of *bɔbɔɔbɔ* musical instruments.

Lastly, driven by the Two-hand Steering Digital Platform model, addressing the fifth research question led to the discovery of a template from the WordPress contentment management system. As required by the creative design, the WordPress template was edited and prepared for it to host the database of sounds and visuals of *bɔbɔɔbɔ* musical instruments created. Again, adhering to the Two-hand Steering Digital Platform model, the database was tactfully uploaded and configured as expected by the creative design.

Indeed, the website created allowed the sounds and visuals of the *bɔbɔɔbɔ* musical instruments to be downloaded and they can also be engaged both online and offline for musical activities on digital platforms.

6.2 Conclusions

It is essential to note that the research into the development of a conceptual model for creating digital platforms for Ghanaian traditional musical instruments is a great triumph. It extends the dearth of literature surrounding digital platforms and Ghanaian traditional musical elements. The development of the model accelerates ongoing discussions about digital platforms for Ghanaian traditional musical instruments and rejuvenates the concept of digitalisation for Ghanaian traditional musical elements. The concept of creating a digital platform should emanate from users' perspectives and the recording, digitisation and digitalisation should be guided by existing written and media materials and digital platforms as the model suggests and the procedure should be based on interdisciplinary ideologies and technological standards woven from a local setting with studio-based research design.

Again, for the first time, a digital platform has been created for the elements in Ghanaian traditional music which considered how the users wanted to use the digital platform. Additionally, it is tangible and feasible to record the sounds and visuals of *bɔbɔɔbɔ* musical instruments, digitally manipulate them and create a website for them to be used on digital platforms by music educators, producers, performers and composers according to how these users want to engage them. It is significantly useful to engage users of Ghanaian traditional musical instruments in creating digital

platforms for the sounds and visuals of Ghanaian traditional musical instruments. Users of Ghanaian traditional musical instruments have digitally emerged with high competencies in technological innovation and possess the most profound ideas in creating digital platforms for Ghanaian traditional musical instruments. In fact, in contrast to creating digital platforms for the sounds and visuals of Ghanaian traditional musical instruments without the intended users' input, the opinions of the users engaged obviously indicate that music educators, producers, performers and composers who use Ghanaian traditional music are not oblivious to the technological possibilities for the sounds and visuals of Ghanaian traditional musical instruments. It is important to conclude that opinions from the users engaged formed the core principles for establishing the needs of the digital society concerning the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms. The revelation from these users oriented the researcher in creating the digital platform, they also described the deficiencies of existing sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms and the reasons why they are not effective in responding to their needs on digital platforms. For instance, videos recorded during Ghanaian traditional musical performances cannot be used to teach how to play *bɔbɔɔbɔ* musical instruments nor can it be used to teach the dance movement and songs unless it has been created with the input of an expert in *bɔbɔɔbɔ* ensemble and technical experts who through various technological schemes and methods can properly craft the videos to suit music education factors.

Additionally, this research serves as one of the groundbreaking studies that clearly described appropriate facility and equipment for the recording and digitisation of

sounds and visuals of *bɔbɔɔbɔ* musical instruments. Due to the researcher's intentions to treat the users' wants with earnestness and integrity, through reflexive means appropriate facilities, audio and visual equipment were explored for this expedition. The facility, audio and visual equipment used for the study were consistent with the demands of the users engaged. Looking at the outcome of this study, the facility, audio and visual equipment used in this study can be considered as a standard suite for the recording and digitisation of the sounds and visuals of Ghanaian traditional musical instruments because they were selected through reflexivity established by the created model. Therefore it may be said that the facility and the audio and visual equipment used in this study are appropriate facilities and equipment that anyone embarking on a similar expedition can use. Scholars and musicians embarking on similar studies can start from the discovered facility, audio and visual equipment.

Moreover, it is worth noting that the recording and the digitisation were done with techniques that were also explored through reflexive means, therefore the discovered audio and visual recording and digitisation techniques can be used to record the dynamic nature of Ghanaian traditional musical instruments whilst maintaining their natural sonic and visual attributes. For instance, the mid-side audio recording technique ensured the preservation of the natural stereophonic sounds of the *bɔbɔɔbɔ* musical instruments. Also, the colour correction and saturation projected the fresh and organic looks of *bɔbɔɔbɔ* musical instruments. Moreover, the wide and close shot techniques employed in the video recordings enabled the caption of both body and hand gestures for easy learning. A database of sounds and visuals of *bɔbɔɔbɔ* musical instruments can

be created using the discovered techniques for music education, production, performance and composition.

Lastly, the website created for the sounds and visuals of *bɔbɔɔbɔ* musical instruments served as the foremost locally created digital platform for the sounds and visuals of *bɔbɔɔbɔ* musical instruments for musical activities on digital platforms. This website is a clear example of a locally created digital platform for the sounds and visuals of Ghanaian traditional musical instruments which emanated from a local technological infrastructure. The WordPress content management system can be manipulated to host the sounds and visuals of *bɔbɔɔbɔ* musical instruments online and offline for musical activities on digital platforms. The WordPress content management system can also provide the possibility of downloading the sounds and visuals of *bɔbɔɔbɔ* musical instruments. This has removed the cultural and locational restrictions and also made the sounds and visuals of *bɔbɔɔbɔ* musical instruments be hosted on multiple digital devices due to the downloadable options with the website.

6.3 Recommendations

The study makes recommendations for how to create digital platforms using elements from Ghanaian traditional musical instruments and idiosyncratic methods from the setting of digital societies that engage these elements for musical activities. To increase the discourse in that regard, it is advised that new digital platforms should be created for the elements in Ghanaian traditional music utilizing the Two-hand Steering Digital Platform model. This proposed conceptual framework can be discussed further, adapted for the creation of a digital platform for the sound and visual elements in Ghanaian and

African traditional music. These technological developments will foster and encourage technological and digital development among ethnomusicology and music scholars who engage traditional music for their activities. The Centre for Research in Culture and Creative Arts (CeRCCA), University of Education, Winneba (UEW) can adopt this model to digitize not only the sounds and visuals of Ghanaian traditional musical elements but also other elements in Ghanaian arts such as sculpture, paintings and textiles.

This study also lends credence to the perception of creating digital platforms without consulting the actual end users of the platform to harness their views in terms of using the elements of Ghanaian traditional musical elements on digital platforms. It is advised that Ghanaian societies have digitally emerged to the level to make profound contributions to technological developments and therefore possess the ability to determine how they want their elements on digital platforms to be established. The study revealed enormous means stakeholders wanted to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms. As technological development continues to advance in major leaps, technological developments should always be based on society's technological orientation and needs. Also, this study focused on only *bɔbɔɔbɔ* musical instruments meanwhile Ghana and African traditional music possess a vast array of elements which are constantly migrated onto digital platforms. These digital platforms should be created with the input of the end users to ensure effective use of digital platforms.

Again, the study outlined the facility as well as the quality of the equipment that can be used to record and digitise the sounds and visuals of *bɔbɔɔbɔ* musical instruments. By employing reflexivity, the study was able to describe appropriate facility, audio and visual equipment for the recording and digital manipulation of the sounds and visuals of *bɔbɔɔbɔ* musical instruments. This study, therefore, recommends the employment of designs that will ensure the reflexive selection of appropriate facility, audio and visual equipment for the recording and digital manipulation of the elements in Ghanaian traditional music in creating digital platforms. Since the studio-based design provided the comfort for reflexivity, the study recommends that initiatives to record and digitally manipulate elements in Ghanaian traditional music should consider the use of studio-based research design to enable adequate exploration for the selection of appropriate facility and equipment for the recording and digitisation of Ghanaian traditional musical elements.

Moreover, it is worth noting that the recording and the digitisation were done with techniques which were also explored through reflexive means. The use of the appropriate technique for digitising the sounds and visuals of *bɔbɔɔbɔ* musical instruments was of particular relevance to this study. As a result, the study's design allowed for the exploration of potential methods for audio and visual recording and manipulation, a crucial component of creating digital platforms but one that is typically absent from the digital platforms already in existence for Ghanaian traditional musical elements. The study suggests that to serve as a technical basis for other researchers and developers, digital platforms should describe the techniques used in recording and digitally manipulating Ghanaian traditional musical elements. Additionally, the

techniques employed in this study were discovered and verified by reflective methods; as a result, the study suggests that effective techniques for recording and digitizing Ghanaian traditional musical elements be explored through reflective methods.

Lastly, the digital platform created (website) for the sounds and visuals of *bɔbɔɔbɔ* musical instruments has made the sounds and visuals accessible to the global world. This initiative has significantly pulled down the cultural and locational barriers which may prevent other musicians from using the digital platform created. The downloadable possibility also made it possible for the sounds and visuals to be hosted on multiple digital devices. This study, therefore, recommends that conscious effort should be made to host sounds and visuals of Ghanaian traditional musical elements on thoughtfully created digital platforms by editing and uploading the database in suitable website templates to expand their access and also provide the possibility of multiple hosting through internet technologies and downloadable options.

6.4 Suggestions for Further Research

I can say with absolute assurance that this research is only the beginning of an idea to create robust digital platforms for the sounds and visuals of Ghanaian traditional musical elements and even African traditional musical elements for music education, production, performance and composition on digital platforms. For researchers in music, musical expeditions in this vein are the potential to liberate sound and visual elements in African traditional music on digital platforms to escape the imperialism of Western sounds and visuals on digital platforms. The methodology and techniques should also serve as a guide for future digital platform creation for Ghanaian traditional

musical elements. The study was restricted to only one Ghanaian traditional instrumental setup considering the many-sided technical structures involved. It is possible to use the established methodology and techniques to digitise the other Ghanaian traditional instrumental setup to expand the collection of the sounds and visuals of Ghanaian traditional musical instruments on digital platforms. Also, the study was restricted to the traditional musical instrument, therefore it could be possible to adopt the methodology and the methods for other elements such as the dance movement, songs and costumes in Ghanaian traditional musical types.

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APPENDICES

Appendix A

Sample of Guiding Questions for the participants

- How will you want to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms for music education purposes?
- How will you want to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms for music production purposes?
- How will you want to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms for music performance purposes?
- How will you want to use the sounds and visuals of *bɔbɔɔbɔ* musical instruments on digital platforms for music composition purposes?
- How will you want to learn how to play *bɔbɔɔbɔ* musical instruments pattern?
- Digital platforms that can host the sounds and visuals of *bɔbɔɔbɔ* musical instruments for the musical activities.

Appendix B

Field Pictures

Pictures of techniques used in audio and visual recording of the *bɔbɔɔbɔ* musical instruments.

Figure 42: Spaced Pair Microphone Technique used to record instrumental patterns

Figure 43: The mid-side recording technique to record the *bɔbɔɔbɔ* musical instruments

Figure 44: Visual recording of *bɔbɔɔbɔ* traditional musical instruments

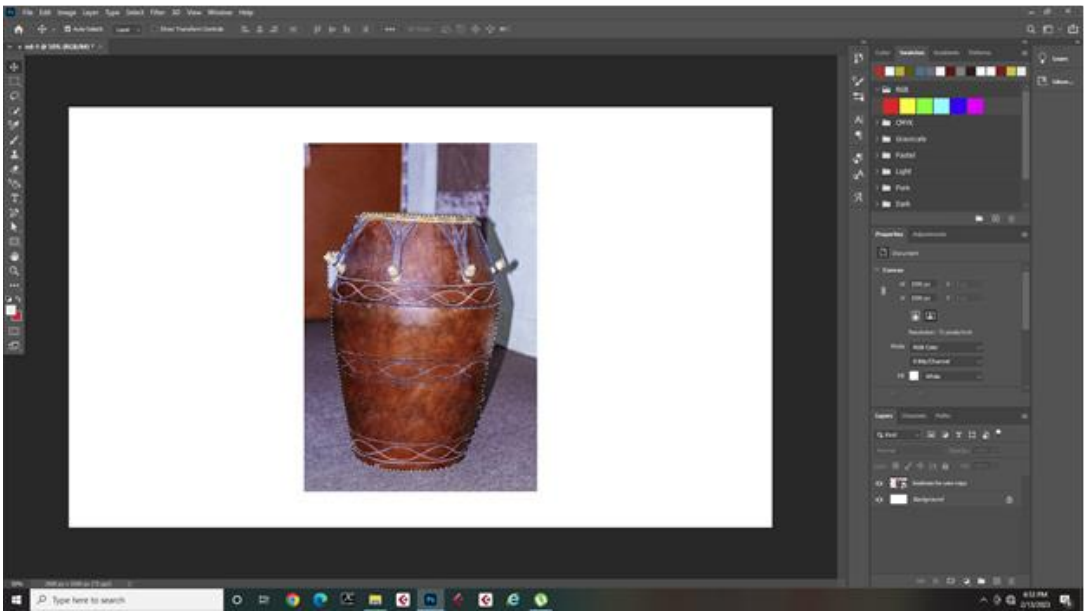

Figure 45: Pictures of the manipulation and editing of the sounds and visuals in Photoshop

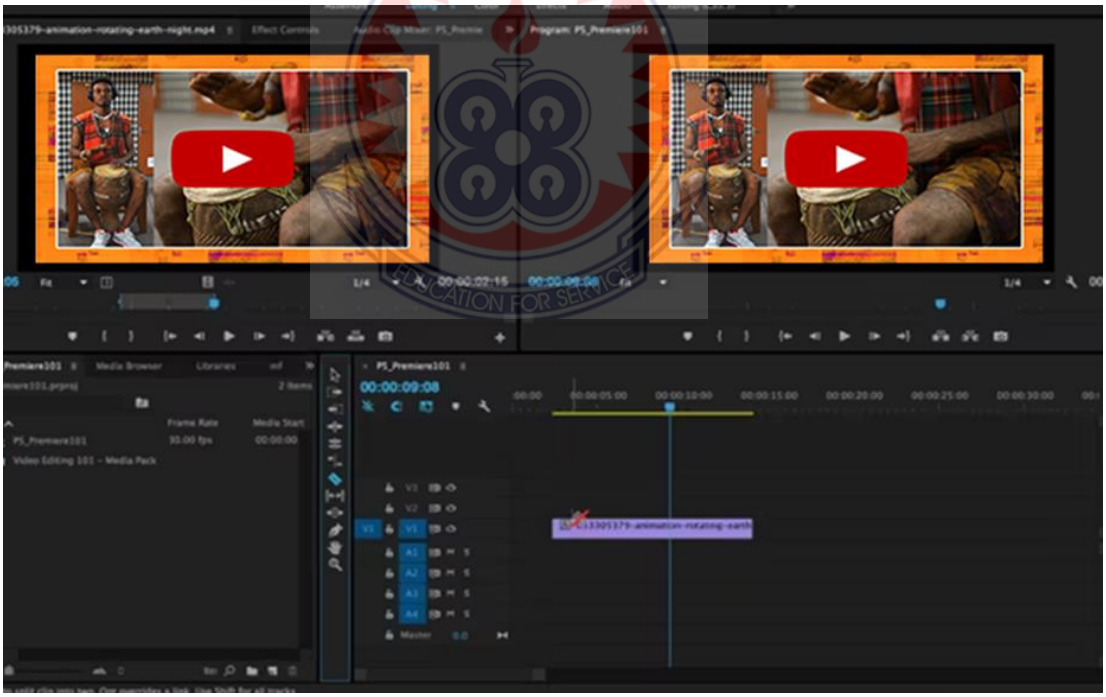

Figure 46: Digital Manipulation of Visual Lessons in Premiere Pro

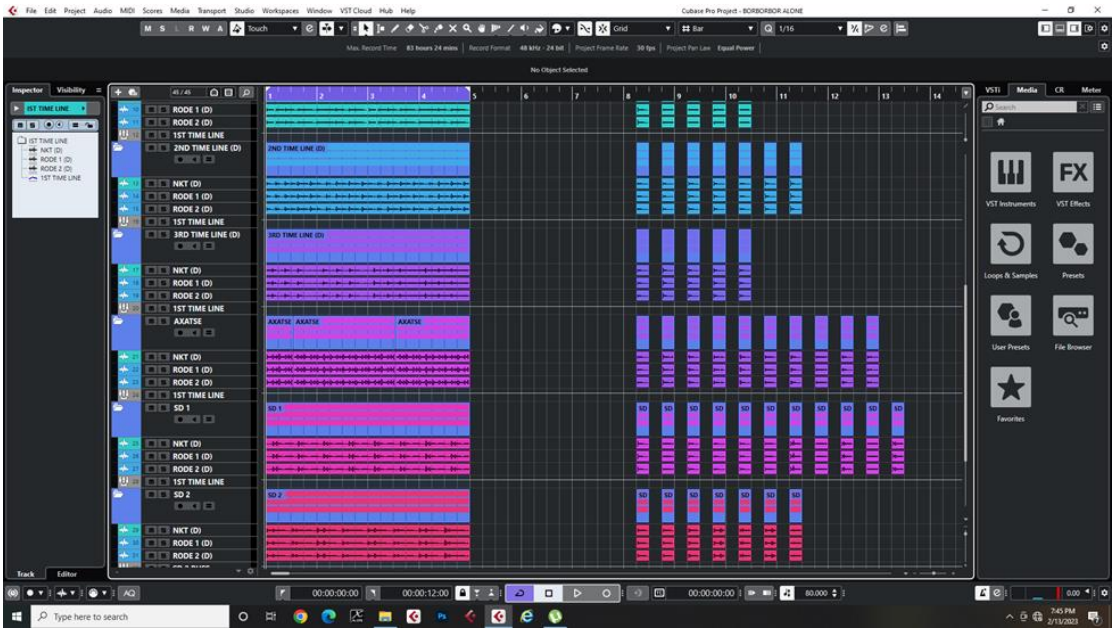

Figure 47: Digital Manipulation of Audio in Cubase 11

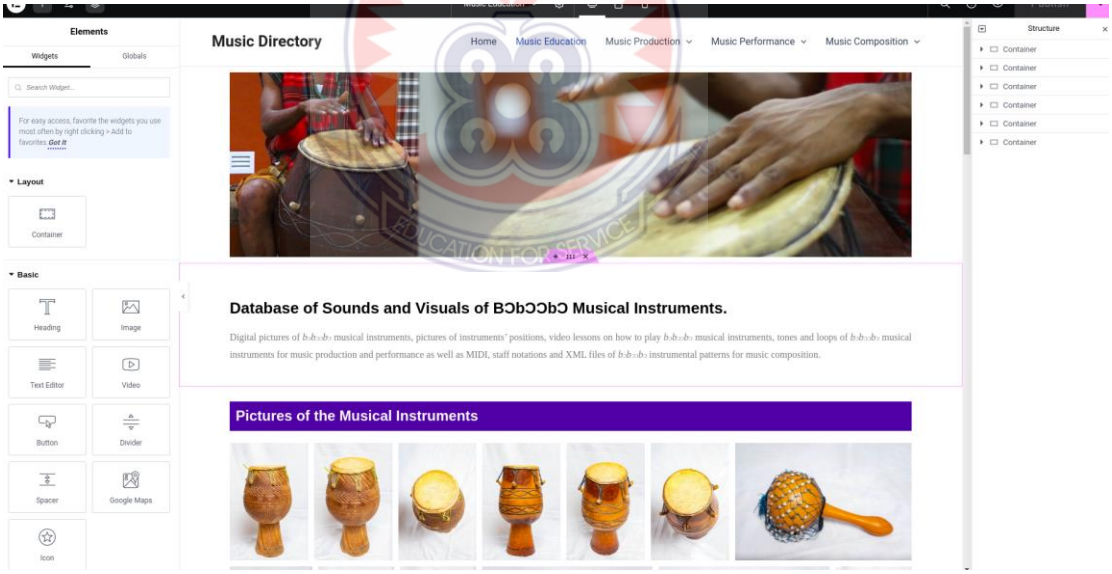

Figure 48: Website for the Sounds and Visuals of *bɔbɔɔbɔ* musical instruments