DECLARATION

I hereby declare that this submission is my own work towards the MFA degree and that to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree by the university, except where due acknowledgement has been made in the text.

LARBI, PRINCE FRANK / 20288051 …….. ……

(STUDENT'S NAME AND ID) SIGNATURE DATE

CERTIFIED BY

MR. HUGHES OFORI DOMPREH …… …….....

(SUPERVISOR) SIGNATURE DATE

CERTIFIED BY

DR. EBENEZER KOFI HOWARD …… ……

(HEAD OF DEPARTMENT) SIGNATURE DATE

ACKNOWLEDGEMENT

A great musician and a renowned educationist; Dr. Daniel Amponsah (Alias Agya Koo Nimo) once said, ''fame is a vapour, popularity is an accident, riches take wings and it is

only one thing that matters; character.'' It is also said that 'goodness is the fruit of the plant that is produced from the seed of the plant that the peacemakers planted with peace.' Based on these two philosophical analogies, I who have come into contact with great minds during this research and wish to be like some of them in the near future, owe it a duty to appreciate them for 'the seed of the plant' that they have planted in me as far as this research is concerned.

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ABSTRACT

AUTHOR: LARBI PRINCE FRANK

TITLE: SEMI-ABSTRACT METAL SCULPTURE ON THE THEME:

‘REFLECTIONS OF AFFECTION’

SUPERVISOR: MR HUGHES OFORI DOMPREH

This project sought to research into welding and fabrication as technological study, and their applications to the production of two sculptural pieces that were not only going to serve decorative but also functional purpose. The artefacts are sculptures which symbolic in concept. The research design used was studio-based research design. The type of research tools used were based on the praxis and exegesis; the triangulation of studiobased research which involves observation, creation and analysis. Facilities for the study were libraries, internet, journals, books, and works of experts in sculpture and the Metal Product Design.

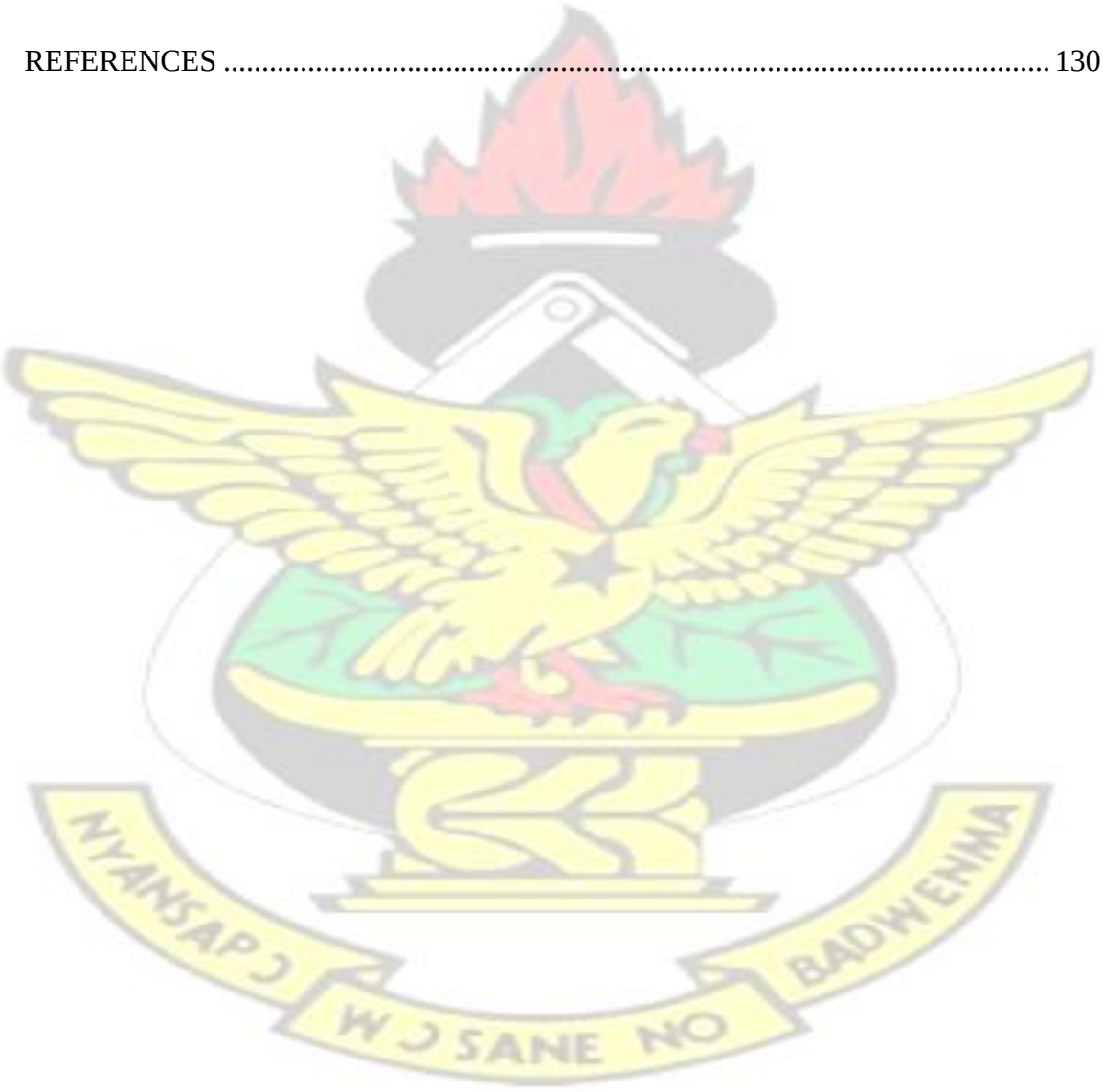
The objectives of the research were to explore the field of welding and fabrication technology as a means of adding to the practical knowledge in academia and other in the near future, to demonstrate the in-depth knowledge gained in other practical Metalsmithing and mild steel forming techniques throughout the research in the designing and fabricating of metal statues.

It also dealt with how to experiment on the effective ways of welding lighter forms of steel to thicker or the heavier forms, to improve upon the use of durable metal statues by placing

emphasis on abstract and semi abstract African lighting figures and to produce metal semi-abstract lighting statues based on the concept; ‘reflections of affection’.

The project report is made up of five chapters and each chapter is subdivided into topics and sub-topics based on the structure of the entire project. It may be of an interest to academia and the general public to know that there are so many types of sculpture, materials for sculpture, sculpting techniques, and functionalities of the various sculptural pieces, but only a few these in Ghana have really been sculpted in metal and have lighting features.

TABLE OF CONTENTS



LIST OF FIGURES

LIST OF TABLES

CHAPTER ONE

INTRODUCTION

1.1 OVERVIEW

This chapter deals with the background to the study, the statement of motivation, the objectives of the research, the research questions, delimitations, limitations, the importance or significance of the research, facilities available for the research and the definition of the various terms as applied to the study.

1.2: Background to the Study

Metal Sculpture is defined as the art of carving, modeling, welding, or otherwise producing figurative or abstract works of art in three dimensions which can be in relief, intaglio, or in the round(Fried, 1980).

It has also been defined as the branch of the visual arts that normally operates in three dimensions. Sculpture is one of the plastic arts. Durable sculptural processes originally used carving which involves the removal of material, and modeling which also involves the addition of material such as clay, stone, metal, ceramics, wood and other materials. A wide variety of sculptural materials may be worked by removal such as carving, assembled by welding, modeling, orcasting (Fried, 1980).

Sculpture has been central in religious devotion in many cultures, and until recent centuries large sculptures, too expensive for private individuals to create, were usually an expression of religion or politics. These cultures whose sculptures have survived in quantities include the cultures of the Ancient Mediterranean, India and China, as well as many in South America and Africa(Barton, 2014).

The Western tradition of sculpture began with the presence of Ancient Greece. Greece is widely noted for producing great masterpieces in the classical period. During the middle Ages, Gothic sculpture represented the agonies and passions of the Christian faith. The revival of classical models in the Renaissance produced famous sculptures such as Michelangelo's David. Modernist sculpture moved away from traditional processes and the emphasis on the depiction of the human body, to the making of constructed sculptures(Barton, 2014).

There are different types of sculpture, some of them being bronze sculpture, bust, carving, marble, mobile, clay or modeling, plastic art, relief or embossment, stabile, statue, solid figure or three dimensional figures all crafted out of the best materials such as wood, plastics, clay, plaster of Paris, cement and a few of them, in metal. Some of these sculptures are real works of art produced through welding (Barton, 2014).

Most mother and child stabiles are made in wood, plastics, clay, plaster of Paris, cement, with metal stabiles being just a few in the system nowadays, most especially, in Africa.

Also, this technique of assembling or fabricating and welding stabiles, has not been much exploited by metalworkers, or metal artists in Ghana when considering it in terms of the totality of sculpture that are surviving (Mbiti, 1969).

This research explored the use of different types, shapes, forms and thicknesses of mild steel for the production of symbolic lighting stabiles and to a large extent, statues that would portray the African tradition as the statues would be based on the roles played by African mothers in the raising children who would reflect the character, attitudes and values of their parents. These stabiles would not just be serving child developmental purpose, but also help enhance the beauty of our environs and for fertility, cultural, moral and symbolic purposes (Rangwala, 2008).

1.3: Statement of Motivation

Mbiti (1969), explains that the African whether traditionalists, Christians, Muslims or any kind of religion, believe in life after deaf. Mother and child figures are meant, not only for fertility as most African traditional fertility figures, but also provide avenues or centers for prayers, serve spiritual, psychological, decorative, economic, and technological purposes, not many of these sculptures commemorate or compliment the vital role played by the African women.

In almost all African societies, sculptural pieces are made by carving and modeling in cement, clay, POP, papier′ Mache′ or plastics with only a few of them in metal. Those in

metals are not even portrayed in female abstract figures that show most of the body parts well pronounced (Mbiti, 1969).

A woman who fails to get children is always unhappy, no matter the other qualities she might possess, her failure to bear children is worse than community genocide. Such a woman is considered the dead end of human life, not only for the genealogical line but also for herself. The childless wife is said to bear a scar which nothing can erase (Mbiti, 1969).

Sculptures produced in Africa using the various types of welding techniques, steel forms and the application of the fragmented sheet metal fabrication and cold bending processes, do are scarcely seen in the African society(Rangwala, 2008).

The most popular mother and child images across the world are those found in the grottos of the Catholic Church which often serve as prayer centers for believers of the catholic faith. These figures, however, are the representative of the western world (Fried, 1980).

In cognisance of the hectic and vital role played by the African woman in society building, the researcher saw the need to conduct this research in honour of the African woman (Mbiti, 1969).

1.4: Objectives of the Research

1. To design two semi-abstract mother and child metal sculptures themed Reflections of Affection.

2. To explore the welding techniques and the fragmented sheet metal fabrication technique in the fabrication of the sculptural figures.

1.5: Research Questions

1(a). What traits must inform the design in order to achieve the meaning of the theme?

1(b). What materials and welding techniques are appropriate in achieving the set objectives?

2(a). What kind of sheet metal forming technique would be exploited in the research?

2(b). How would the aesthetics and utilitarian features of the sculptures be achieved?

1.6: Delimitation

The research explored techniques such as oxy-acetylene welding, electric Arc welding, brazing, sheet metalworking, and cold forming techniques amongst others, in the fabrication processes.

1.7: Limitations

- The source of power for the welding setup is only one, both undergraduates and postgraduates depend on this same source and machine for power to weld which partly delayed the project.

- Workshop facility for the Postgraduates at the Metal Product Design Section is such that welding may sometimes have to be done in the absence of other students, or be done outside since there is neither a welding table nor a welding booth. This exposed the work to early corrosion and also affected the sights of passerby.
- Financial constraints due to frequent increases in prices of mild steel and other products for fabrication and finishing.

1.8: Significance of the Research

- This research would help promote the learning interest in students who would like to take up other projects involving the various techniques in welding and fabrication.
- The project would develop more practical skills in welding and fabrication, and other metalsmithing techniques such as the fragmented sheet metal forming and cold forming techniques, mild steel forming, beating metalwork.
- Designing and fabricating such statues in metal would help improve upon the usage abstract African mother and child lighting statues in both the local and international Ghanaian institutions and workplaces.

- Through this project, more would be added to the already existing African concepts, designs and products in terms of mother and child statues that could be promoted internationally

1.9:Facilities Available.

The facilities available for the project were

- The postgraduates' studio at the Metal Product Design Section (Department of Industrial Art), KNUST.
- KNUST library, ICT Center and College of Art Library, KNUST.
- Electric Arc welding setup.
- Gas welding setup.
- Welding and Fabrication, soldering and brazing books.
- Journals.
- LPG equipment for brazing and soldering.
- Fabrication and finishing equipment, tools and Material shops in Kumasi.

1.10: Definition of Terms

Fabrication- the entire production activities or process followed in coming out with the sculptural pieces from the cutting stage to the finishing.

Mild steel- iron carbon alloy containing less than 0.25 percent of carbon which were bought and used to fabricate the sculptures.

Shrinking- reducing the extensions at the datum of the metals by the use of an electrode which burns away the projections in order to pave way for the fixing and welding of other fragments.

Stretching-bending and pushing the metal with mallets and hammers in order to create contact points for welding two or more pieces together.

Fusion-welding the fragments of metals together by making sure that they melt and form one single unit.

Biological imperative-childbearing, which is considered very important in every human society.

Oxy-Acetylene welding- Also known as gas welding; the type of welding process that has to do with the use of oxygen and acetylene gas and a specially designed torch which can fuse metals by a hissing high temperature flame.

Arc welding- Also known as Electric Arc welding; the type of welding that makes use of electrodes and a transformer, generator, or a rectifier as its source of heat.

Brazing- a type of joining process where filler rods were used to seal certain gaps and holes created as a results of too high current resulting in too much heat affecting the sheet metal and causing parts to burn off.

Metalsmithing- the entire craft and skill applied in producing the sculptures from all the various forms of metal especially non-ferrous.

Symbolic- the representation of others, idea, a proverb or the African concept.

Lighting statue- statues that have electrical connections.

Abstract sculpture-the types of sculptures such as those in this research which are not based on reality, but are from the mind of the creator and best explain themselves.

Semi-abstract sculpture-the sculptures in this research that have some key parts portrayed somehow real with certain parts also strictly based on the explanations of the artist.

Reflections –parents looking at their babies from the mind`s eye and thinking about how best they love each other.

Affection- the love and care the mothers and the babies in this study, have for each other.

Beating metalwork –forming some fragments of metals by annealing the metal and then using tools such as metal stakes and chasing or raising hammers to come out with the fabricated product.

Sheet metalwork-forming the sculptures and their pedestals by precision process such as marking-out, setting-out bending, twisting and cutting and then joined by welding and brazing.

Sculpture in the round-three-dimensional sculptures such as those in this research that can be viewed from all angles.

Bust–the upper part of the bodies of these sculptures; from the chest up.

1.11: Abbreviations

- **GMAW**-Gas Metal Arc Welding
- **GTAW –** Gas Tungstun Arc Welding
- **SMAW –** Shielded Metal Arc Welding
- **KNUST –** Kwame Nkrumah University of Science and Technology
- **AC** - Alternating Current
- **DC –** Direct Current
- **AC/DC** - Alternating Current/ Direct Current
- **(Auto CAD)**- Auto Computer Aided Design

CHAPTER TWO

REVIEW OFRELATED LITERATURE

2.1: OVERVIEW

The previous chapter gave a brief background to the study, statement of problems, suggested questions that can lead to achieve the objectives to the study as well as the importance of the study and outlined some limitations and delimitations of the study. This chapter focuses on the individual variables that constitute the title of this research. The major areas to be considered include ‘welding’, where the definition of welding, types of welding, would be taken into consideration.

The research would also cover the history and the various definitions given to metal fabrication by either blacksmiths, engineers or other metal artists, some metal fabrication processes, fabricated products and the kind of finishing given to those products.

The description of mother and child statue, the history of statue; most especially metal mother and child statue, the importance of metal mother and child statue over all the other types of statues, the business aspect of lighting statue manufacturing and the need for symbolic lighting statues would also be given prominence.

Finally, the research would delve into the type of armatures, their constructions and suitability to the various types of statues.

2.2: WELDING

2.2.1: **Definition of Welding**

The definition of welding is considered very important with regard to such research which is intended to impart knowledge to the general public, especially those who may not have had enough knowledge about what it entails.

According to Untracht (1985), welding involves the ability of metals to be joined which is influenced by their metallurgical, chemical, physical, and thermal characteristics. The term welding implies that the surfaces are joined in a molten state. The weld is a localized union between the parts formed in a relative short time.

Moreover, according to Derek(2008), blacksmiths and engineers have another technical explanation for the term under review. Welding, in engineering can also be defined as the process in which two or more pieces of metals are joined by the application of heat (fusion), pressure (non-fusion) or combination of both. Also engineers hold another view that almost all the processes could be grouped into two major categories. The first being Heat welding(or fusion welding) which involves Arc Welding, Gas Welding, Thermite Welding, Electron Beam Welding And Electro slag Welding. The second is the Pressure Welding which also involves Resistant Welding, Forge Welding, Pressure Welding and Ultrasonic Welding. These are the most common welding processes used.

It should also be noted that there are other means of joining metals called Brazing and

Soldering which are not specifically welding processes, but they have been mentioned here since they are auxiliaries to welding in all spheres of the engineering industry and are used by professionals in similar fields (Derek, 2008).

2.3: TYPES OF WELDING

Considering the above definitions and explanations given to the term welding and the other joining techniques, the researcher deems it very vital to state and describe the characteristics of the various types of welding so that students, researchers and those who have the interest in using welding as a means of gaining employment, manufactories and manufacturing companies would choose the type to adopt.

2.3.1: GMAW or Gas Metal Arc Welding (MIG Welding)

More commonly called MIG welding, this welding type is the most widely used and perhaps the most easily mastered type of welding for industry and home use. The GMAW process (Fig.2.1) is suitable for fusing mild steel, stainless-steel as well as Aluminium (Rodney, 2004).

Fig 2.1: GMAW or Gas Metal Arc Welding process

2.4.: DEFINITION OF METAL FABRICATION

Marcoe (2012) stated that any time one form of metal is manipulated or changed into another form, it is called "fabrication." Metal fabrication is primarily used in industry, jewellery arts and crafts, and technological areas. It is a generally accepted belief that metal was discovered before people began to write and was first used to make tools and weapons such as arrowheads. Metal fabrication processes and techniques are also scientifically referred to as metallurgy.

Fabrication, when used as an industrial term, applies to the building of structures, by cutting, shaping and assembling components made from steel. Steel fabrication shops generally concentrate on the preparation, welding and assembly aspect with a much greater

use of the multi functioning machines with many aspects of the labour intensive work automated (MacKay, 2014).

Fabrication (cutting and drilling features) of structural steel elements has always been performed using manually operated techniques, and these remain today as fabrication methods. The emergence of CNC (Computer Numerical Control) technology brought automation and greater accuracy to these techniques, resulting special purpose machines dedicated to performing individual fabrication tasks.(MacKay, 2014).

MacKay(2014),said that metal fabrication is a series of processes used to manufacture an object from metal. The specialized equipment involved includes laser cutting machinery, turret punches, rollers, welding machinery, water jets, and metal shears. The metals most commonly used for fabrication are aluminium, stainless steel, and carbon steel, which are in the form of sheets, tubing and bars. Most metal objects start life as sheet metal in varying thicknesses depending on the application, but thicker sheets are known as metal plates.

2.5.: THE HISTORY OF METAL FABRICATION.

Metal fabrication began in the earliest civilizations when the metals gold, mercury, silver, tin, iron, lead, and copper were discovered. These metals were worked by early artisans into decorative pieces, religious iconography, and jewellery. Items of a practical nature were forged from metal including coinage, tools, and weapons. Using heat and tools,

metalworkers began to make functional objects and the industry developed through the years advancing and gaining value from society (Matt, 2014).

2.6.: SOME METAL FABRICATION TECHNIQUES/ PROCESSES

2.6.1: Cutting and burning

The steel plates or sections have to be cut to size with a variety of tools. The most common way to cut steel is by shearing, which is a metalworking process which cuts without the formation of chips or the use of burning or melting. When the cutting blades are straight the process is called shearing. The most commonly sheared materials are in the form of sheet metal or plates. A band saw uses a blade consisting of a continuous band of metal with teeth along one edge. There are also abrasive cut-off saws, known as chop saws, which are similar to miter saws, but come with a steel cutting abrasive disk (Matt, 2014).

Cutting torches can cut very large sections of steel with little effort. In oxy-fuel cutting, a cutting torch is used to heat metal to kindling temperature. A stream of oxygen then trained on the metal combines with the metal which then flows out of the cut (kerfs) as an oxide slag (Matt, 2014).

According to Matt (2014), Burning machines are CNC cutting torches, usually fuel gas powered, plasma or laser cutting. He added that recent years, developments in plasma

cutting and laser cutting of metals have been combined with computer motion control to accomplish the sequential operations on a single machine.

According to Amoakohene (2000), Drilling is described as the process of making round holes in metals by the use of a drill.

Matt (2014), wrote that a drill line has long been considered a very important way of drilling holes and milling slots into beams, channels and sections. CNC drill lines are typically equipped with feed conveyors and position sensors to move the element into position for drilling, plus probing capability to determine the precise location where the hole or slot is to be cut.

Welding can be described here as the process of joining two or more metals together by fusing or non-fusing the parent metals together with a molten metal which melts and forms a very strong bond called a weld (Amoakohene, 2000).

Welding is a major focus of steel fabrication. The formed and machined parts will be assembled and tack welded into place then re-checked for accuracy. The welder then completes welding following the weld specification to match the requirements of the general arrangement (Matt 2014).

2.6.2: Metal Shaping

Metal shaping is actually the major process termed ‘fabrication’. Metal Shaping or forming can mainly change metal in four ways. You can bend, cut, shrink and stretch metal to form it (Matt, 2014).

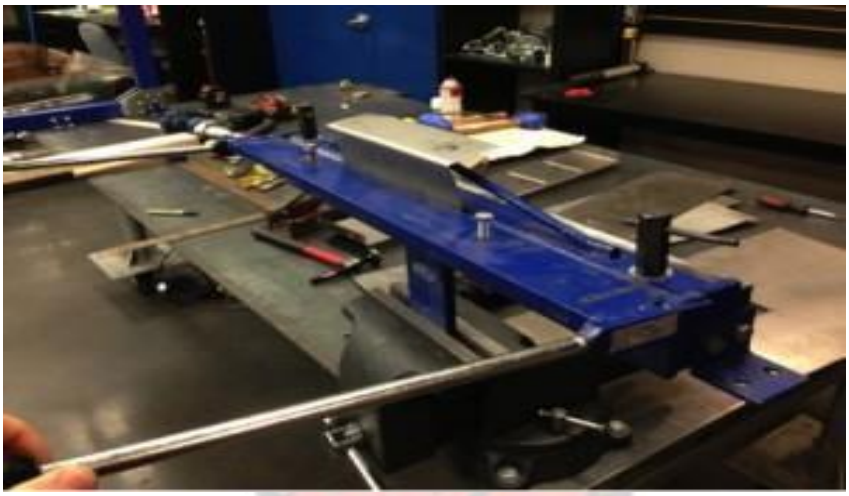


Fig 2.2: Sheet metal shaping equipment.

2.7.0: HISTORY OF SCULPTURE

According to Gormley (1998)Sculpture is the branch of the visual arts that operates in three dimensions. He further states that durable sculptural processes originally used carving which is the removal of material, and modelling which is the addition of material such as clay, stone, metal, ceramics, wood and other materials.

Gormley (1998) believes that since modernism, shifts in sculptural process led to an almost complete freedom of materials and process, wide variety of materials may be worked by removal such as carving, assembled by welding, or cast.

Gormley (1998) postulated that sculpture in stone survives far better than works of art in perishable materials, and represents majority of surviving works other than pottery from ancient cultures.

2.7.1: Sculpture in the Ancient World

According to Gormley (1998), the earliest civilizations of Egypt, Mesopotamia, the Indus Valley, and China gradually developed forms of writing about 3000 B.C. The people of these civilizations, like their prehistoric ancestors, also expressed deeply felt beliefs in the roles sculpture played in their lives.

Gormley (1998) said, Egyptian sculpture and all Egyptian art were based on the belief in a life after death. The body of the Egyptian ruler, or pharaoh, was carefully preserved, and regalia were buried with him to provide for his needs forever.

The pyramids and some great monumental tombs of Giza, were built for the most powerful early rulers. Gormley (1998) added that the Pharaoh and his wife were even buried in chambers cut deep into stones.

Historians have adopted a special set of terms to suggest the main changes in the development of Greek sculpture and of Greek art in general. The early, or Archaic, phase lasted about 150 years, from 625 to 480 B.C. A short interval called Early Classical or Severe, from 480 to 450 B.C., was followed by a half century of Classical sculpture. Late Classical indicates Greek art produced between 400 and 323 B.C. (Gormley, 1998).

2.7.2: Etruscan metalworkers and Roman Sculpture

Gormley (1998) writes that by the 7th and 6th centuries B.C. the Etruscans were firmly settled in Italy and that hundreds of objects had been found, and were still being found in

vast Etruscan cemeteries. Some of the sculpture and many vases are Greek, while others are lively Etruscan translations of Greek forms. Many small bronze figures of farmers, warriors, or gods show the great talents of the Etruscans as metalworkers and sculptors.

2.7.3: Early Christian Sculpture

Sculpture, however, was not a natural form of expression for the early Christians. This was because one of the Ten Commandments forbids the making of graven (carved) images. Many early Christians interpreted this commandment, just as the Hebrews had, to mean that it was wrong to make any images of the human figure. Eventually church authorities decided that art could serve Christianity. It was only the making of idols (false gods) that was regarded as a breach of the commandment. (Gormley, 1998).

2.7.4: Romanesque Sculpture

According to Gormley (1998) the term "Romanesque" suggests the Roman qualities of the art of the 11th and 12th centuries. Important changes were made by these later artists. A new chapter in Christian art began after the year 1000AD. For the next three centuries sculptors, architects, masons, carpenters, and hundreds of other craftsmen created some of the most impressive Christian churches ever built.

2.7.5: Gothic Sculpture

Sculpture after the 12th century gradually changed from the clear, concentrated abstractions of Romanesque art to a more natural and lifelike appearance. Human figures shown in natural proportions were carved in high relief on church columns and portals.

The faces of the statues have expression, and their garments are draped in a natural way. Hundreds of carvings in the great Gothic cathedrals all over Western Europe presented aspects of the Christian faith in terms that every Christian could understand (Gormley, 1998).

2.7.6: Neoclassic and Romantic Sculpture

Gormley (1998) parabolically said that, the pendulum of taste swung in a new direction in the late 18th century when Clodion (1738-1814) and other sculptors were still active.

The most commanding figure of neoclassical sculpture was the Italian Antonio Canova (1757-1822). Canova was a favorite of the kings and noblemen of Europe.

2.7.7: The history of metal sculpture

According to Barton (2014) during the 1920's and 1930's, the constructivists built rather than carved or modeled their sculptures. The beauty of pure form and space excited them.

The Russian brothers Naum Gabo (1890-1977) and Antoine Pevsner (1886-1962) used blades of metal and plastic to achieve an effect of lightness and transparency. Julio Gonzalez (1876-1942) introduced the use of forged iron. The tremendous influence of his

technique is seen particularly in the work of Picasso, a student of Gonzalez in the technique of welding.

Barton (2014) explains further that in the 1960's and 1970's, still more new styles developed. Some artists chose to portray subjects from the everyday world around them such as the Brillo boxes and soup cans of Andy Warhol (1928-87), the surrealist boxes of Joseph Cornell (1903-72), the plaster hamburgers and "soft typewriters" of Claus Oldenburg (1929). Others combined painting, sculpture, and "found objects," as in the work of Marisol Escobar (1930). George Segal (1924-2000) used plaster casts of human figures in everyday poses.

Louise Nevelson (1900-88) combined small units of metal and wood (often table and chair legs, bed posts) into huge structures that she called "environments." Sculptors like Barnett Newman (1905-70) and Tony Smith (1912-80) created massive pieces that are often shown outdoors. Some sculpture not only moves but is run by computer (Barton, 2014).

2.8.0: TYPES OF SCULPTURE

According to Gormley (1998), there are many types of sculpture but they can generally be grouped into two. These are addition sculpture where material such as clay, metal, wax, cardboard, or Papier′ Mache is largely added on to create the form. The other type is the reduction sculpture where material such as stone, wood, or ice, is entirely taken away in order to create the form.

There is a basic distinction between sculpture in the round, free-standing sculpture, such as statues which are not attached to any other surface except possibly at the base, and the various types of relief, which are at least partly attached to a background surface(Gormley, 1998).

Another distinctive technique is subtractive carving which removes material from an existing block or lump, for example of stone or wood, and modelling technique which shapes or builds up the work from the material.

Techniques such as casting, stamping and moulding use an intermediate matrix containing the design to produce the work; many of these allow the production of several copies. The term sculpture properly covers many types of small works in three dimensions using the same techniques, including coins and medals, hard stone carvings and a term for small carvings in stone that can take detailed work(Gormley,1998).

Modern and contemporary art have added a number of non-traditional forms of sculpture, including sound sculpture, light sculpture, environmental art, environmental sculpture, kinetic sculpture (involving aspects of physical motion), land art, and site-specific art. Sculpture is an important form of public art and a collection of sculpture in a garden setting can be called a sculpture garden (Gormley, 1998).

2.9.1: The Virgin Mary and the church

This mother figure is a central object of worship in several religions. for example, images of the Virgin and Child call to mind Egyptian representations of Isis nursing her son

Horus. The history of the Virgin Mary, mother of Jesus Christ, depends on texts of the Gospels in the bible. As it has been an embellishment to her legend, it seems to have taken form in the fifth century in Syria (Heilbrunn, 2000).

2.9.2: The Virgin Mary in Byzantine Representations

The Virgin Mary, known as the Theotokos in Greek terminology, was central to Byzantine spirituality as one of its most important religious figures. As the mediator between suffering mankind and Christ and the protectors of Constantinople, she was widely venerated. The Virgin is the subject of important liturgical hymns, such as the Akathistos Hymn, sung at the Feast of the Annunciation (March 25) and during Lent.

Most images of the Virgin stress her role as Christ's Mother, showing her standing and holding her son. The manner in which the Virgin holds Christ is very particular. Certain poses developed into "types" that became names of sanctuaries or poetic epithets (Heilbrunn, 2000).

2.9.3: The Virgin Mary in Western Representations

According to Heilbrunn (2000) the twelfth and thirteenth centuries saw an extraordinary growth of the cult of the Virgin in Western Europe, in part inspired by the writings of theologians such as Saint Bernard of Clairvaux (1090–1153), who identified her as the bride of the Song of Songs in the Old Testament. The Virgin was worshipped as the Bride

of Christ, Personification of the Church, Queen of Heaven, and Intercessor for the salvation of humankind (Fig. 2.3 -2.5).

Fig 2.3

Fig. 2.4

Fig. 2.5

Fig. 2.3- 2.5: Representations of Madonna and child: the cult of Virgin Mary in the Middle East.

2.10.0: Abstract Metal Sculpture

According to the Encyclopedia of Art, the 1960s also witnessed the beginning of a new broad tradition of metal sculpture, ranging from the portable to the monumental. Such works included: Sculpture For a Large Wall, by Ellsworth Kelly (b.1923); Midday, by Sir Anthony Caro (1924-2013); Die, by Tony Smith (1912-1980); Broken Obelisk, by Barnett Newman (1905-70) and a number of works by Eduardo Chillida (1925-200).

Fig. 2.6: Abstract Expressionism Sculpture painted steel on cinder block base. By David Smith

Fig. 2.7: Bronze Emotion sculpture; abstract love token sculpture. By Rosemond Lloyd.

Accessed at
http://www.pinterest.com

2.10.1: Importance of Mother and Child sculpture

"A person who has no descendants in effect quenches the fire of life, and becomes forever dead since his line of physical continuity is blocked if he does not get married and bear children". This is why mothers at all times would like their children to reflect the affections they have for the younger ones (Mbiti, 1969).

Images of women holding children may reflect a number of ideas, for example, they may represent the affections of mothers, fathers, ancestors and serve as "symbols of lineage or clan forbears, the generalized and incarnate dead" (Cole, 1985).

It is believed that the childless wife bears a scar which nothing can erase. She will suffer for this; her own relatives will suffer for this and it will be an irreparable humiliation for which there is no source of comfort in traditional life. Mother and child statues are therefore mounted at their abodes as a symbol of hope that it would still be possible for barren women to also bear children (Cole, 1985).

CHAPTER THREE

MATERIALS AND METHODS

3.1.1: Research Design

The research design adopted by the researcher could be justifiable here, in that, the research concerned among other things, how metalsmiths would have to exploit the field of welding and fabrication technology, demonstrate the in-depth knowledge gained in other practical metalsmithing processes such as cutting, bending, twisting and forging, combining the mechanical properties of mild steel such as ¼ rods, 3/8 rods, flat bars, 12mm steel rods, 1½ inch angle irons and 1mm steel sheets, and the application of the forming techniques in their day-to-day line of production.

The objectives of the research was accomplished through descriptive research design and Studio-Based Action Research.

3.1.2: Descriptive Research

The qualitative aspect of the descriptive research included review and analysis of articles, other research publications, journals, website publications, books on metal fabrication, hand sketches, hand drawings, computer aided designs (Auto CAD), oral interviews, oral discussions with people in the sculpture and engineering field, experts in metalsmithing, practical experiences gathered over the years and also during this research in welding and

fabrication and the production of metal mother- and -child sculptural pieces at the metalsmithing studio.

These helped in getting deeper understanding of both the past and prevailing practices in these areas. The oral interviews and discussions with experts in the sculpture, engineering, the metalsmithing fields and colleague students helped to clarify and appreciate the views and opinions of academicians, engineers, sculptors and great metalsmiths, thereby providing much more ideas for the future development of metal sculpture fabrication in Ghana.

3.1.3: Studio Based Research

Studio based research mainly involved the production of the artifact, or the fabrication stage and writing of the project report. It employed the application of praxis and exegesis. The praxis aspect took care of basically the practical work, which involved a cycle of observing, creating and analysing what has been created. The exegesis took care of the description of how the work was created, the problems encountered, how problems were solved, and the importance of the artifact and whether or not, the objective of the research or the concept around which the artist was working, was attained.

Together the praxis and the exegesis that the artist went through from the designing stage till completion of the project, it can confidently be described as a research work, (Marshall, 2010).

According to Marshall (2010) these components of the studio based research can be evaluated based on the following five factors:

1. Description of the subject matter of the artifact produced
2. Identification of iconography
3. Notation of the impact of the selected media and the method of production.
4. Principles of art and the organization of visual elements such as line, shape, colour, space, texture, movement, time and composition.
5. Description of style and or process.

This study adopted metalsmithing based production process to fabricate the artifact and obtained a result which is typically a lighting sculpture on the theme 'Reflections of Affection'. The welding and fabrication techniques used for the production of the artifact offer a lot of advantages as compared to the other methods that could have been used.

These advantages include effective and efficient use of different steel products, cutting down double expenditure by mounting platforms for sculpture pieces, mobility and durability. Techniques such as hollow metal sculptures fabricated with lightweight sheet metals without strong armatures may not be as durable or able to sustain external pressures as these, and those made of plaster of Paris, cement, clay, or of other materials, would have required another form of support which comes with an extra cost.

3.1.4: The Design

The designing stage of the project involved a series of sketches which led to the outcome of the actual artifacts which the researcher chose as masterpieces for fabrication. The figures 3.01 to 3.07 below show some of the series of sketches and drawings that helped to arrive at the blueprints for this project work. Fig. 3.06 and Fig. 3.07 were selected for further development till the final drawings for the fabrication were obtained.

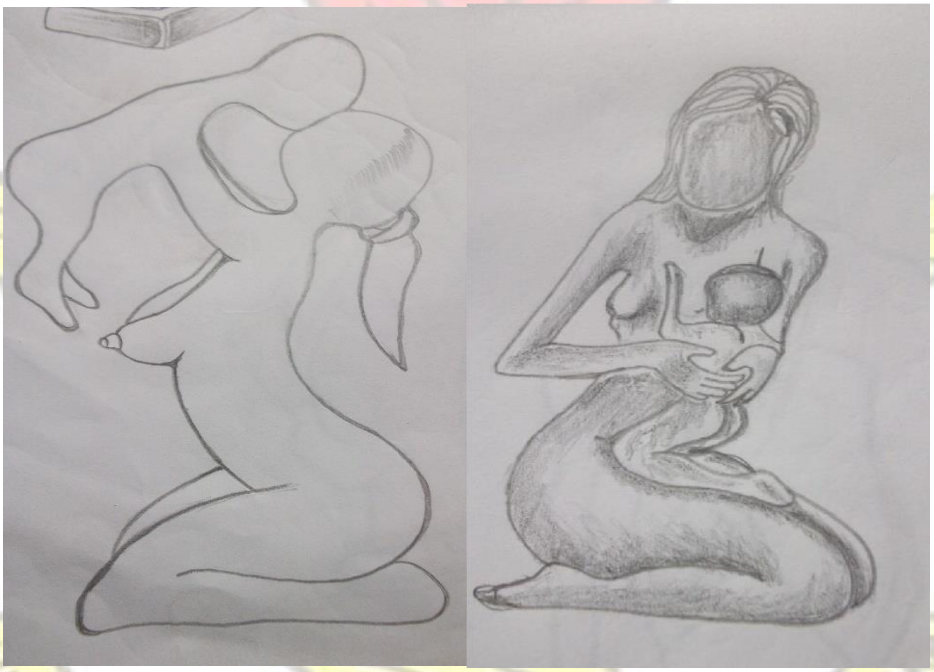


Fig. 3.1 **Fig. 3.2**

Fig. 3.1- 3.2: Series of sketches and drawings at the designing stage.

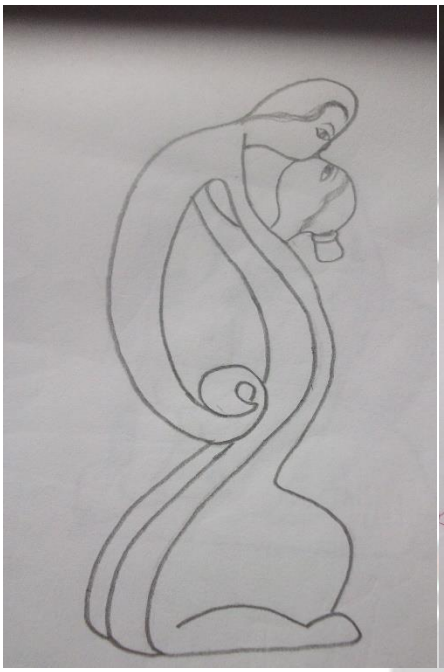


Fig. 3.3

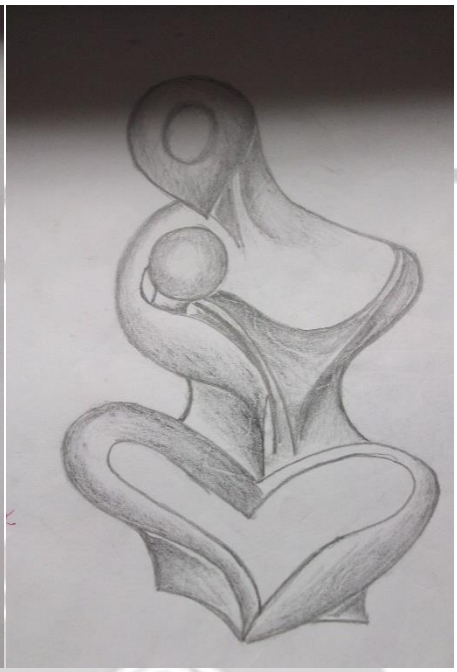


Fig. 3.4

Fig. 3.5

Fig. 3.3- 3.5: Series of sketches and drawings at the designing stage.

Fig. 3.6 **Fig. 3.7**

Fig. 3.6- 3.7: Series of sketches and drawings at the designing stage.

Fig. 3.8: This figure was selected for the first statue.

Fig. 3.9: This figure was selected for the second statue.

3.2: Materials and Tools (Introduction)

This stage of the research focused on the major materials and tools used in the execution of the practical project. Some had been described briefly before their uses during the studio-based work; others were only mentioned while others also had only their uses stated.

3.2.1: Materials for the Research

The major materials used in the fabrication process were steel forms. Some of the steel forms were 12mm steel (or iron) rods, 6mm steel rods (popularly known as 1/4 Rods), 5cm angle bars (popularly known as 2 inches Angle Iron), 1mm steel sheet, ¾ flat bars, ½ inch flat bars. 2.5mm and 3.2mm Welding electrodes, 17 bolt-and-nuts, 1.5 electrical cables, 4 switches, 2 lamp holders and 2 bulbs including other auxiliary materials such as fillers, primers and paints were also employed in this project.

Steel (or iron) rods (12mm)

These are available in circular cross-sections with diameter varying from 5mm to 250mm. They are widely used reinforcement in concrete structures, construction and steel grillwork. The most commonly used cross-sections have diameters varying from 5mm to 25mm with the corresponding weight per meter length as 1.50N and 38N respectively. In this research, six of such rods were used. They were used as reinforcement for the skeletal framework and also as the support inside the pedestal, for the sculpture piece (Rangwala, 2008).

Fig. 3.10:steel (or iron) rods (12mm)

Steel rods (6mm)

Six millimetre steel rods are very flexible and pliable forms of steel extruded rods mostly used for binding light weight structural works and also for fabricating meshes and other netlike products. Since the research was jeered towards welding heavy metals to lighter ones, eight of these rods were also employed in the entire project to link other parts of the armature. They were mainly used for the fabrication of the skeletal heads of the sculptures (Rangwala, 2008).

Fig. 3.11:steel rods (6mm)

Angle Bars/Angle Irons (5cm)

The angle sections may be of either equal or unequal legs. The equal angle sections may vary from 20mm × 20mm ×3mm to 20mm × 200mm × 25mm.the corresponding weight per meter length are respectively 9N and 736N. The unequal angle sections are available in sizes varying from 30mm × 20mm × 3mm to 200mm ×150mm × 18mm. The corresponding weight per meter length is respectively 11N and 469N. The main functions of angle sections are extensively in the structural steelwork especially in the construction of steel roof trusses and filler joist floors, but in the research, three full lengths of such bars were used for the construction of the rigid framework of the pedestal or the support base that carries the entire weight of the statues (Rangwala, 2008).

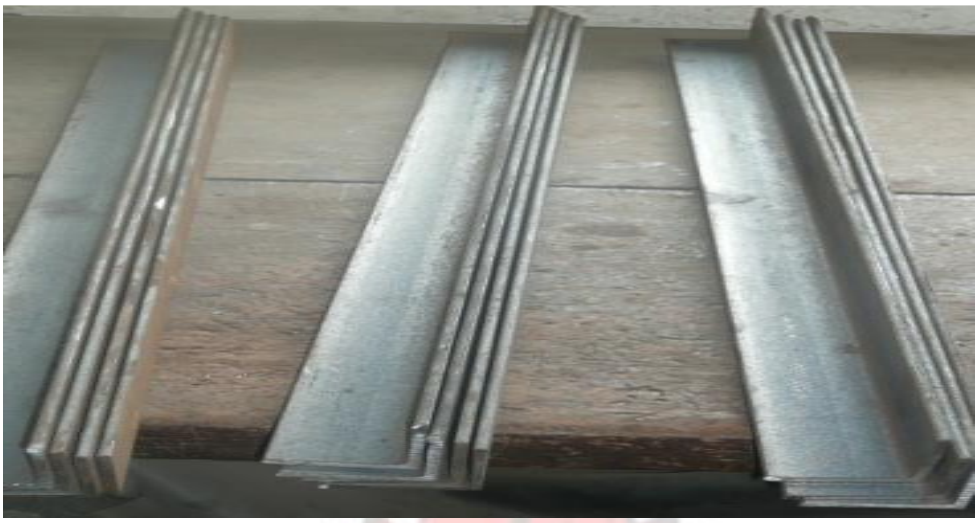


Fig. 3.12: pieces of 5cm angle bars

Steel sheet (**1mm)**

These were flat forms of steel manufactured in sheets of 0.5mm, 0.8mm, 1mm, 1,25mm, 1.5mm, 2mm, 2.5mm, 3mm, 3.5mm, and 4mm.other flat metals greater than these thicknesses are referred to as metal plates. Due to its light weight and its pliability, ductility and malleability, they can most of the time be used for works that would require a lot of bending, cold working, hollowing and sinking. Four of the 1mm steel sheets were used for the fabrication of the outer coverings, or the 'skins' of the sculpture pieces.

Some were also used to cover the pedestal (Rangwala, 2008).

Fig. 3.13: a section of 1mm steel sheet and another 1mm sheet from which templates were being cut.

Flat Bars (¾ inch and ½ inch)

These are also extruded forms of steel. They come in varied sizes depending on the kind of fabrication or engineering works. Some have thicker cross-sections while others are of thinner cross-sections. Seven pieces of flat bars were used for the fabrication of the armature that served as the interior support structure for the sheet metal templates (Rangwala, 2008).

Fig. 3.14: Flat Bars (¾ inch)

Welding electrodes (2.5mm and 3.2mm)

2.5mm welding electrodes are sometimes referred to by other welders as the Grade 12 electrode while the 3.2mm Welding electrodes can also be referred to as the Grade 10 electrodes. The bigger the electrode, the smaller the grade number and vice versa. The 3.2.mm electrodes were used in joining the thicker metals when building the armature while the 2.5mm electrodes were used in joining the quarter rods, the flat bars and the sheet onto the armature. One packet of the 3.2mm electrodes and four packets of the 2.5mm electrodes were used for this project.

Fig. 3.15: A packet of 2.5mm electrodes

Bolt-And-Nuts

Bolts are the cylindrical rods of metal with external threads cut on the outer surface to serve as male during fastening operation while nuts are mostly hexagonal disk-like form of metal having internal threads to serve as the female during fastening. In this project, four bolts and nuts have been used to root the sculptures onto the ground in order to prevent them from falling in case of any heavy storm.

1.5 Electrical Cables

These are the types of copper cables that were used by the researcher to connect electricity from the wall outlet to power the bulbs that would provide the reflections that the babies would conceptually be portraying. In all, 1800cm of 1.5mm copper cables were used for the entire project.

Fig. 3.16: cables and other electrical accessories used for the project.

Switches, Lamp Holders and Bulbs

These are the electrical materials used with the cables to connect electricity onto the sculpture pieces. Two switches, two lamp holders and two bulbs were used for this research.

Flexible PVC Pipe (25mm)

PVC Pipes were used to provide double insulation for the copper cables. This is because, as an external and lighting sculpture, there is the possibility of thermodynamics that can

cause the cables to melt and attach themselves to the inner walls of the sculpture causing the statue to be electrified, which in turn can damage or even kill anyone who touches the statue.

Fig. 3.17: From left to right are turpentine, primer, hardeners and filler, chocolate brown and golden yellow flamingo oil paints used for spraying the artifacts.

Filler

Filler material was used to conceal all possible cracks and holes in the joints that might have been created during the welding process and also for dressing up shapes and forms that might have deformed during the fabrication process.

Primers and Paint

These are finishing materials. After grinding and sanding, the primer was first painted over the entire surface of the work to give the work a uniform surface. An anti-rust coating was also applied before spraying the work in the actual colours.

3.2.2: Tools and Equipment for the Research

The various tools and equipment used for this project have been categorized based on their functions. They are; measuring, marking-out and setting-out tools, cutting tools, shaping/forming tools, holding tool, striking tools, joining tools/equipment, safety equipment and electrical accessories.

3.2.2a: Measuring, Marking-Out, Setting-Out Tools,

This group of tools included all the tools such as permanent and board markers, tape measure try square and the scriber used for the marking and drawing of lines and shapes on the various materials.

Fig. 3.18: Markers

Fig. 3.19: tape measure

Fig. 3.20: try square

Fig. 3.21: the scriber

3.2.2b: Cutting Tools,

These included all the tools which were used in one way or the other in the removal of parts of either metal or the manila card. Below were the cutting tools.

Fig. 3.22:junior hacksaw

Fig. 3.23: hand saw

Fig. 3.24: cold chisel

Fig. 3.25: scissor

Fig. 3.26: hand snip

Fig. 3.27: jig saw

Fig. 3.28: hand files

Fig. 3.29: hacksaw

Fig. 3.30: guillotine machine

Fig. 3.31: portable electric grinder

3.2.2c: Shaping/Forming Tools

These were the tools with which the various cold bending and shaping operations were carried out. They included metal stakes and the anvil

Fig. 3.32: metal stakes

Fig. 3.33: the smith's anvil

3.2.2d: Holding Tool,

These included the tools used in holding the metals in various ways for measurement, cutting and shaping operations to be carried out. They were bench vice and pliers.

Fig. 3.34: bench vice

Fig. 3.35: pliers

3.2.2e: Striking Tools,

These were the tools used to impact blows or force onto the metals in order to effect a change in the original or the assumed shapes of the metals. Striking tools include hammers and mallets.

Fig. 3.36: A hammer

Fig. 3.37: wooden mallets

3.2.2f: Joining Tools/Equipment.

These were the tools and equipment used to apply the actual welding processes which were the main techniques being explored in this research. They included the Miller A/C 225 welder and its accessories, and the oxy-acetylene welding setup.

Fig. 3.38: Oxy-Acetylene Setup

Fig. 3.39: Miller A/C Welder

In addition to these, the study did not also compromise on safety. He was almost always in safety clothing and equipment such as the baseball cup, goggles, gloves, safety boot, an over-coat with braces.

3.3.0: THE FABRICATION STAGES

3.3.1: Preparation of materials.

The entire preparation of steel forms involved a lot of processes. Some of which were:

- procurement and transportation,
- straightening,
- measuring and marking out,

- cutting and
- Coldbending.

3.3a: Procurement and Transportation

Materials, especially the various forms of steel were bought and transported from the market to the studio for further preparation processes to be carried out. The procurement process was swift because a survey and window shopping had already been done around for better and suitable prices. Conveying the metals to the studio was done with the assistance of the traders' own dispatch vehicle.

3.3b: Straightening the metals

Due to the length of some of the steel forms, it became necessary that those that were pliable enough and could be bent such as the flat bars, quarter rods and the 12mm iron rods were bent before transporting them to the studio. Upon reaching the studio, they were straightened again for easy measuring, cutting and setting out processes to be carried out.

3.3c: Measuring and marking out

Metals were measured according to the required length for first, the fabrication of the framework for the pedestal (base), secondly, the fabrication of the grids which the armature was supposed to be welded onto, and thirdly, the fabrication of the major pillars or the vertical frameworks of the statues.

Fig 3.40 **Fig. 3.41**

Fig. 3.41- 3.42: the measuring and marking out operations on the angle bars to be used for fabricating the pedestal.

3.3d: Cutting

After measuring and marking out, the bars were cut in preparation for the welding process. All the cutting at this stage was done manually with the use of the Pistol Type Hacksaw set with an 18 TPI blade.

Fig. 3.42 **Fig. 3.43**

Fig. 3.43-Fig. 3.44: the cutting of the iron rods and flat bars used for the vertical framework of the stabiles

3.3e: Cold Bending

The type of bending process used for the entire project was cold bending. At this stage, the cold bending technique was used to bend the 12mm iron rod manually with the aid of a bench vice; the flat bars were also bent manually with a sketch of the required shape drawn on a flat tabletop. Sheets and quarter rods were bent on wooden and metal stakes with the aid of a wooden mallet.

Fig 3.44

Fig. 3.45

Fig 3.44and**Fig. 3.45:** bending of the 12mm iron rods using the bench vice

Fig. 3.46

Fig. 3.47

Fig. 3.46to **fig. 3.47**: manual bending of flat bars on a flat tabletop and in a bench vice.

All the above processes were carried out to prepare the various steel forms for the actual fabrication of the statues.

3.4.0: The Main Fabrication Processes

The main fabrication processes for these two metal statues were technically put under the following six headings:

- Fabricating the pedestal/platform/base
- Fabricating the armatures
- Pattern making and templating
- Welding and fabrication of the bodies of the statues
- Light fittings
- Finishing processes

3.4.1: Fabricating the Pedestal

Square platform which would be attached to the base of the artifacts were fabricated in order to avoid any further expenses in mounting other platforms for these works. It was also one of the objective to try to improve upon the rigidity and static nature of most mounted statues, by making these works somehow mobile so that the user can easily move them any time there would be the need for a change in the positions of the artifacts, may be due to renovation or relocation of the user or users.

After the preparation of the steel forms, the researcher chose to use angle bars for the fabrication of the pedestal. The sizes of angle bars used had been discussed in the

'materials for the research' section of this project. Setting out (checking squareness of angles) was done by the use of engineer's square (popularly known as set square). Tackwelding of the various components was done. After the tack-welding process had been completed, joints were Arc welded. Below were the chronological processes followed in the fabrication of the armature for the platform:

Fig. 3.48: shows the tack-welding of the angle bars to form the top square component of the platform

process on the upper part of the platform, or the pedestal.

Fig. 3.49 shows the Arc welding

After welding the upper part of the platform, the legs of 15cm each, were also welded at right angle to the inner corners of the platform and in order to provide a strong and rigid support for the main bodies of the statues, the 12mm iron rods were measured to the fit the inner angles of the platform and welded at 15cm square intervals inside its length and breadth

Fig. 3.50

Fig. 3.51

Fig.3.50 – 3.51: show the welding of the iron rods inside the platform which would be serving as the attaching points to the main bodies of the armature and that of the artifacts.

3.4.2: Fabricating the Armature for the first statue

This stage of the fabrication process involves the formation of a framework or an armature used for making the statue. The base or the pedestal served as the support for both armatures and a flat bar was hand bent to form the armature for the heart.

Fig 3.52 shows the welding of the fabricated heart shapes being welded onto the base of the armature.

After welding the bent bars to form the front and back of the heart shape, some bars were welded to connect the front part to the back and also three vertical rods of 122cm each, were also cut and welded vertically to form the major skeletal support for the armature. After this, the total height of each of the 122cm rods was divided according to the overall height of the statue and the number of head lengths.

Fig. 3.53: depicts the welding of the horizontal reinforcement and the vertical iron rods for the main armature.

The shoulder slope or the diagonal segment for the shoulder-to-neck joints were also measured in order to check the gentleness or the steepness of the slopes before joining the sides and the back.

Fig 3.54: measuring the right shoulder

The back, left, right and front sides of the armature were fabricated by bending flat bars and ¼ rods to either C-curves or S-curves and then welded onto the parts mentioned to build the armature.

Fig.3.55: welding the side and the back bends

The stomach, front and back parts of the heart shape were also fabricated by bending flat and round rods which were welded to the vertical rods according to how the forms were required.

Fig.3.56: Forming the heart and the stomach section.

The armature for the mother's arms and that of the baby's bust, were formed by bending C-curves and ovals which were further welded together taking cognisance of the forms, length and the sizes.

Fig. 3.57: Fabricating the mother's arms

Fig. 3.58: Fabricating the baby's bust

The chest was formed with ¼ rods bent in C-curves and joined to the neck and the collar bones while the head was formed with ¼ rods bent into bigger size ovals than those used for the baby's head and were also welded onto the top of the neck. The figures below show the fabrication processes described here and the complete armature.

Fig. 3.59: Forming the chest and the head of the armature.

Fig. 3.60: the complete armature

3.4.3: Pattern Making and Templating

Patterns are most of the time cut out in papers before they are placed on metal sheets or plates where their outlines are drawn onto the metal to be cut for use. Template can be described as the cut-outs created out of the actual material to be used for a particular fabrication work.

This section of the research involves the cutting out of shape or parts of the main body of the statues in cards called patterns (Fig. 3.61-3.66). Here, eight pieces of A1 manila cards were acquired for the two artifacts and with the help of a tape measure, board and permanent markers and a pair of scissors, patterns were cut out.

The individual parts and or shapes of the sculptures were dealt with as different units during the cutting out process. This process has been described as the 'Fragmented sheet metal cold forming technique'.

After a successful pattern making, the patterns were placed on the sheet metals individually and technically, chisels and hammers were used to cut most of the simple shaped templates while a jigsaw was also used to cut out the complicated templates.

Fig. 3.61: some manila card patterns **Fig. 3.62:** using a pair of scissors to cut out a pattern

Fig. 3.63: cutting a template with a Jigsaw

Fig. 3.64: cutting a template with chisel and hammer

Fig. 3.65

Fig. 3.66

Fig. 3.61-3.66: show samples of some patterns and templates prepared for the fabrication of the main bodies of the statues.

3.4.4: Cladding the armature of the first Statue

The study, with the aid of the Arc welding set, fabrication tools and equipment, metal stakes, the welding table and a wooden table for keeping the templates, was able to systematically put the 1mm sheet metal templates together according to the shapes and forms of the unit parts of the statue using the Arc welding technique. Other techniques applied in the fabrication process were cutting, bending, stretching, twisting, pressing and many others.

The fabrication steps or processes for the various components of the statue have been successively and clearly explained with the aid of the figures and their descriptions below.

The forming of the statue started from the back. Three different templates were used to form the back; the templates for the left back, right back and the center back. The left and right backs were first welded after which the center back was also welded to complete the entire back. The figures below show how the back part was formed.

Fig. 3.67: the left and right back

Fig. 3.68: The complete welded back of the statue

Here, templates were twisted to suit the shapes or forms of the abstractly designed left and right thighs which also form the heart-shape on which the mother's body symbolically and abstractly rests. The figure 3.86 below shows the tack-welding of the thighs.

Fig. 3.69: Tack-welding the thighs

The entire heart-shape which proverbially or symbolically represents the totality of affections that mothers have for their children, was fabricated by welding the templates together starting from the right back to the left back, through the front left and then to the front right. The templates were cut into fragments since the shapes were somehow

protruding, and then welded one after the other in succession till the entire heart shape was completely achieved. The figures below explain how the fabrication was done.

Fig. 3.70: Fabrication and welding of the heart shape

Fig. 3.71: the complete back part of the heart shape which also serves as the buttocks of the statue.

Fig. 3.72: the complete front part of the heart shape which serves as the thighs, legs, or feet of the abstract statue.

The researcher was able to use the cut-out templates to form the chest region, the mother's left and right hands, and the left and right sides of the mother's stomach region. They were all welded together onto the armature as a means building the body of the statue. The templates for the mother's chest and that of her left hand were cut in the form of truncated cones. The one for the mother's chest was opened up, flattened and bent in a somehow concave form before welded onto the armature. That of her left hand was folded at the datum before being attached to the armature and welded.

The mother's right hand was fabricated out of three different templates; the part that links the armpit to the right side of the stomach region, the outer part of the hand and the top part of the hand. The stomach region was also divided into left and right which were fabricated out of two templates which were welded to the central part of the armature in front while the other ends were attached to the left and right ends of the back. The parts discussed in this section have been portrayed in the figures below.

Fig. 3.73: welding the mother's chest and the left hand

Fig. 3.74

Fig. 3.75

Fig. 3.74 and 3.75: fabricating and welding the mother's right arm and the stomach region.

The two heads; the mother's head and that of the baby, were also fabricated out of elliptical shapes. Four elliptical shapes were used for the mother's and that of the baby's, six smaller ones were used. All the shapes were bent convex joined in fragments till the researcher arrived at the head shapes. The baby's torso was also fabricated out of four templates: two for the chest and the back, while the other two were used for the left and right shoulders. Due to the posture assumed by the mother, her neck region formed part of the various templates, but the baby's neck was formed and welded out of a strip of metal. The figures below show the fabrication of the part mentioned.

Fig. 3.76 **Fig. 3.77**

Fig. 3.76 and Fig. 3.77: show the mother's head and the baby's neck being fabricated

The fabrication of the first statue was brought to a successful completion by creating compartments on both the sides and the top of the base or the support, to allow for easy and decorative attachment of the templates which would be functioning as tiles that cover the entire base. Other templates were also cut out for the sealing of the top part of the platform (or the base).

Fig. 3.78: creating compartments on and around the platform

Fig. 3.79: using templates to tile the platform

Fig. 3.80: the complete welded statue before grinding

3.4.5: Grinding

Both small and bigger size Bosch portable electric grinders were used to grind almost all the joints and also the rough surfaces created as a result of the welding processes. Below is a picture showing ground work.

Fig. 3.81: the ground statue

3.4.6: Filler Work on the first statue

Metal filler was mixed with hardener which was applied little by little to fill places which had some folds and rough surfaces due to hammering, pushing, and uneven folding. Because the filler had to be allowed to dry properly before sanding, it was left overnight.

Fig. 82: filler work being done on the statue.

3.4.7: Sanding

After the filler work had been allowed to perfectly dry, the work was sanded by the use of portable electric grinders. The sanding material was attached to the grinding discs and the surfaces of the artifacts were sanded to the required shapes and smoothness before the application of primer.

Fig. 83: sanding work being done on the first statue.

3.4.8: Application of Primer

One of the four-liter buckets of primer was purchased and used for the primer work. The primer was diluted with gasoline since the turpentine bought for such a purpose, was not working as expected. The actual application was done by the use of a medium sized compressor machine connected to a five meter hose and a spray diffusing cup. Fig. 3.100 below shows the primer application process.

Fig. 3.84: Primer Application on the Statue.

3.4.9: Light Fittings

Though the light fittings or the lamp shades were fabricated during the actual fabrication processes, they have been highlighted at this section of the report in order not for the processes to repeat themselves.

The light fittings serve as the means of reflection that had already been discussed in the early part of the chapter. They were fabricated out of quarter rods, flat bars, sheet metals, aluminium foils, mica glass and electrical accessories such as 1.5mm cables, lamp holders, bulbs, flexible spiral PVC tubes, switches and sockets. The metals were used to create the framework whiles the mica glass created translucent reflective openings. The electrical accessories were used for the electrical power connections.

The service of an expert in electrical and electronics on campus was employed to assisted in the fitting of the lighting system which included connecting cables that could tap electrical power from any switch on the walls closer to where these statues would be mounted. The figures below show some of the light fitting materials and processes.

Fig. 3.85: some electrical accessories used for the light fittings

Fig. 3.86: showing the connection and fabrication of some light fittings

3.4.10: The Final Spraying Processes

This stage of the finishing process involves the use of different colours of coral paint which served as the final outward appearance of the two artifacts. The colours chosen were dark-brown and black. Coral paint was sprayed onto the works to give them smooth, decorative and protective finishing.

The seated figure carrying the baby on the right chest was also sprayed with a darkbrown paint on the body and black paint for the platform. The figure below shows how the various finishing processes were carried out.

Fig. 3.87: spraying the body

Fig. 3.88: spraying the platform

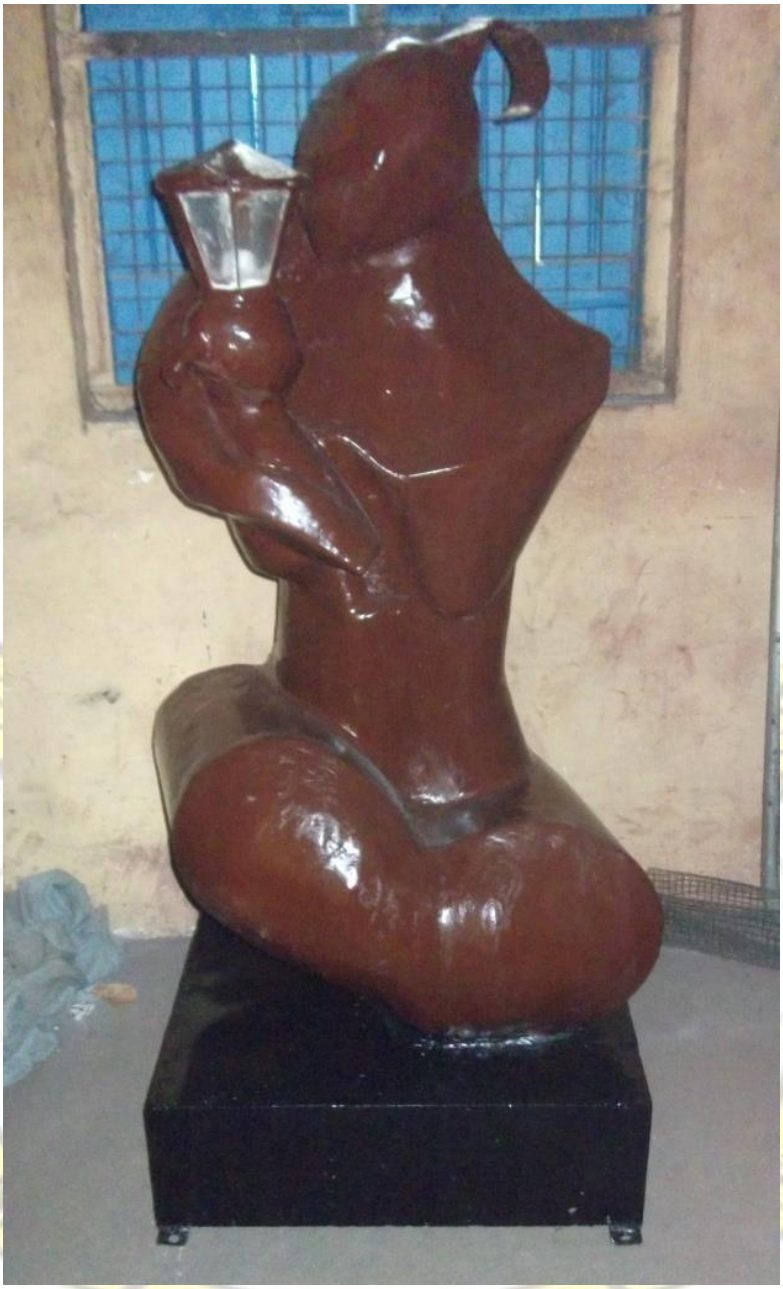


Fig. 3.89: The finished first statue

3.5.0: Fabricating the Armature for the second statue.

One of the main objectives of fabricating two different sculptures was to compare and contrast the weight of both statues with respect to the materials used. This was done by calculating the quantity of the various steel forms used in fabricating each of the sculpture pieces. The first statue was found to have been fabricated with much less materials which also had less weight than that of the second. The posture of the second artifact also contributed to the quantity of materials since it was more complex as compared to the first work.

This stage of the fabrication process involves the formation of a framework or an armature used for making the second statue. Since fabrication of the platform or the base had been discussed earlier, the researcher had to move straightforward to present and discuss how the armature and the main body for the second artifact were constructed.

The major framework of the armature which were joined out of iron rods, were constructed by using two rods joined side by side at every section as the height kept on increasing. This framework serves as the attaching points for the bent rods and the flat bars.

Fig. 3.90: welding the armature

After the attachment has been built, quarter rods and flat bars were used for the fabrication of rings and other curvatures that could easily give the shapes and forms needed to build the main body of the statue. The figure below depicts the fabrication of the sides, the lower part, upper part and the framework for the head of the armature.

Fig. 3.91: Joining rings to the attachment

Fig. 3.92: fabricating the upper part of the armature.

Fig. 3.93: the complete armature for the second statue.

3.5.1: Cladding the Body of the second Statue.

The study applied most of the folding, bending, twisting and wrapping techniques that were used to fabricate the first statue in the fabrication of this artifact as well. Though the posture of this statue was more complex than the previous one, almost all the materials, processes, tools and equipment used in fabricating the previous work, were used in this work as well.

The building of the main body of the second artifact started with the welding of the chest region which extended to the upper part of the belly closer to the breast, and the left and right upper arms. Because the entire work was cold welded and shape forming was a little difficult, the chest region was divided into two sections with the lower section forming part of the upper belly and the armpit. These two sections were welded together by Arc welding process. The arms were also divided into sections and later welded together as shown in the figures below.

Fig. 3.94: welding the chest and the two upper arms together

Fig. 3.95: welding the lowwer partof the stomach

The next stage of the body building was on the waist, the back, the occiput and the neck of the mother. The templates for the building of this part of the artifact was also fragmented ; the waist region into two parts, two templates for the back and truncated cylinder for the neck of the mother figure. The templates were joined by welding them in an overlapping manner from the waist to the upper part of the back.

The head was formed out of four different oval shape templates, but only the occiput was first fabricated due to the light fittings that had to be done later. The neck of the mother figure was folded round that part of the armature and then welded at a joint and to the top edges of the back. Parts which could not meet each other exactly were welded using unshielded electrodes and quarter rods as filler metals. The processes described here have all been portrayed in the Figure.3.96 – 3.98.

Fig.3.96: welding the back of the figure with overlapped the templates.

Fig. 3.97: attaching the neck and the back to the upper arms.

Fig. 3.98: joining the neck to the occiput

The study proceeded with the fabrication of the lower arms, thighs, legs, feet and the buttocks of the mother figure. Templates cut flat and folded into truncated forms of cones were used for the lower arms with other pieces of templates joined to them at points closer to the armpits of the baby figure abstractly to serve as the finger and palm that held the baby on both sides. The thighs of the artifact were each formed out of four different half-oval templates which were bent slightly in order to achieve the curvature in human thighs. See the figures below for pictorial descriptions.

Fig. 3.99: welding the lower arm.

Fig. 3.100: forming and joining the thigh.

The legs were formed out of folded templates which were attached to the lower parts of the thighs. The feet were formed differently due to the posture assumed by the mother figure. The left foot was formed out of two templates; one for the top of foot which also abstractly covers the toes and one for the heel which was joined to the top of the platform with its sides welded to the ankle region. The right foot was formed out of three different shapes of templates. One for the sole, an H-shape for the top of foot and a half-oval shape for the toe region that rested horizontally on top of the platform. Thses activities have been demonstrated in Figure 101.

Fig. 3.101: Attaching the feet to the platform, or the base.

As shown in the figures below this description, the buttocks of the mother figure was fabricated out of two templates; one for each half of the buttocks, but the template for the right buttocks was bent in such a manner that it could take the form of the posture created as a result of the figure kneeling on that leg. These two templates were welded both to the inner sides of the thighs and to the lower part of the waist.

Fig. 3.102: joining the inner part of the buttocks and the thighs together.

The researcher fabricated the baby figure with parts of it having an armature, but its limbs were without armature not because of reduction of weight, but for easy attachment to the main body. The back and the front parts of the baby figure were formed out of two templates. One template was used for the buttocks, the left and right sides were covered with a template each, with the arms formed out of two tubes that were also manually cold formed. One end of each tube was flattened and grounded to the shape of abstract fingers

Fig.3.103: Welding the buttocks and the back of the baby figure.

The legs and feet of the figure were also formed out of tubes and oval shapes respectively. The neck and the head were fabricated out of strips of metal and six pieces of oval shape respectively with the middle part of the baby figure head left open which would reflect the symbolic light that would have its switch in the head of the mother figure. This baby head was cut open with quarter rods lining the edges of each half and a hinge connecting both at the occipital which could pave way for the opening and closing of the head during fixing and changing of bulbs.

Fig. 3.104: Setting the hinge for easy opening and closing

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The breasts were formed out of two truncated cones. The cones were cut in slanted forms to make them possible to hang in a protruding manner from the chest down. Before fixing the breast, holes were created at the very spot where they were to be fixed in order to avoid unnecessary heat causing the metal to melt during welding and also air pockets getting trapped in them. The figures below show the cones used in forming the breast and the welding process.

Fig. 3.105: Cones used in forming the breast.

The head of the mother figure was sealed half way inside because of its symbolic function. On top of that seal was connected the switch that would make it possible for the baby's head to reflect the affections that the mother proverbially wanted it to portray. The possibility of such a connection would answer the analogy that most decisions taken by children and for that matter, humans, are informed or influenced by the thoughts of our parents, especially mothers.

The other half of the head which formed the cover of the head, was also fabricated out of two oval shape templates lined at the edges with a flat bar having locking mechanisms along the inner ring making it impossible for it to fall off. It also has a hinge at the mouth area which makes it easier for opening and closure.

Fig. 3.106: the head of the mother figure. .

Here, the platform was fabricated in an enclosed form since the work would not require any other form of platform before mounting. The sides and the top of the platform were connected with flat bars which served as the attaching points for the tiles of sheet metal that were used to cover the entire outside of the platform. Pieces of flat bars drilled to take 17 bolts, were also cut and joined to the base of the angle irons at each of the corners to provide for the rooting of the artifact into the ground when the need arises. The figures below show how the platform was tiled.

Fig. 3.107: Creating attachments for thewelding of metal tiles

Fig. 3.108: welding the metal tiles from the outside

Below is the completed statue yet to go through finishing processes which would involve grinding, filler work, light fittings and spraying.

Fig. 3.109: the welded second statue.

3.6.1: Finishing Processes

Unlike the fabrication processes, the finishing processes were done simultaneously for both artifacts in that, some of the chemicals or materials would have dried or spoilt if they had been reserved to be used on the other artifact in a later hour. The finishing processes involved grinding, filler work, sanding, priming and spraying. Fig. 3.110 below shows some of the chemicals and other materials used for the finishing processes.

Fig. 3.110: from left to right are turpintine, primer, hardeners, filler and paints in the white plastic containers.

3.6.2: Grinding

The bigger size Bosch portable electric grinder was used to grind almost all the joints and also the rough surfaces created as a result of the welding processes. Below is a picture showing ground work.

Fig. 3.111: the ground work showing the sheen left by the action of the grinder.

3.6.3: Filler Work

Metal filler was mixed with hardener which was applied little by little to fill places which had some folds and rough surfaces due to hammering, pushing, and uneven folding as in the case of the former statue. Because the filler had to be allowed to dry properly before sanding, it was left overnight. Fig. 3.112below shows how the filler work was done.

Fig. 3.112:shows the filled statue.

3.6.4: Sanding

After the filler work had been allowed to perfectly dry, the work was sanded by the use of portable electric grinder. The sand paper was fixed onto the grinding disc of each of the grinders and with their spinning actions, the surfaces of the artifacts were sanded to the required shapes and smoothness before the application of primer (Fig. 3.113).

Fig. 3.113: The statue being sanded.

3.6.5: Application of Primer

The primer was diluted with gasoline and used for the priming as in the case of the former statue. The actual application was done by the use of a medium sized compressor machine connected to a five meter hose and a spray diffusing cup. Fig. 3.114 below shows the primer application process.

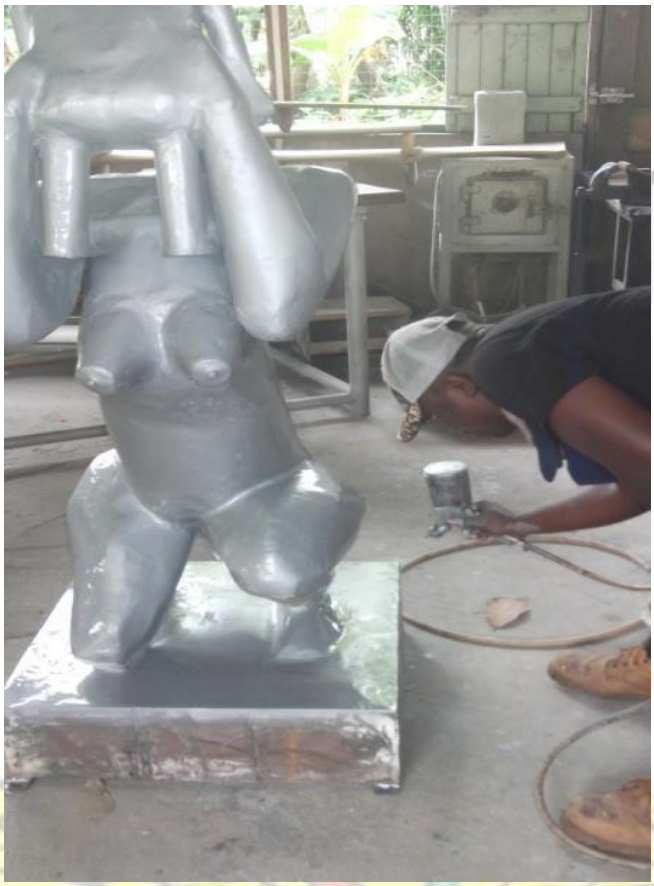

Fig. 3.114: The primer application process.

3.6.6: The Final Spraying Processes

The finishing process involve the use of different colours of 'coral' paint which was used for the final colour of the two artefacts. The colours chosen were dark-brown and black. The paint was sprayed onto the works to give them smooth, decorative and protective finishing.

The squatting figure was sprayed with the dark-brown colour depicting the actual skin tone and black paint for the platform. The seated figure carrying the baby on the right chest was

also sprayed with a dark-brown paint on the body and black paint for the platform. The photograph below shows how the various finishing processes were carried out (fig. 3.115).

Fig. 3.115: the body of the artifacts being sprayed.

Fig. 3.116: Spraying the platform

Fig. 3.117

Fig. 3.116 and Fig. 3.117: The sprayed platforms of the artifacts.

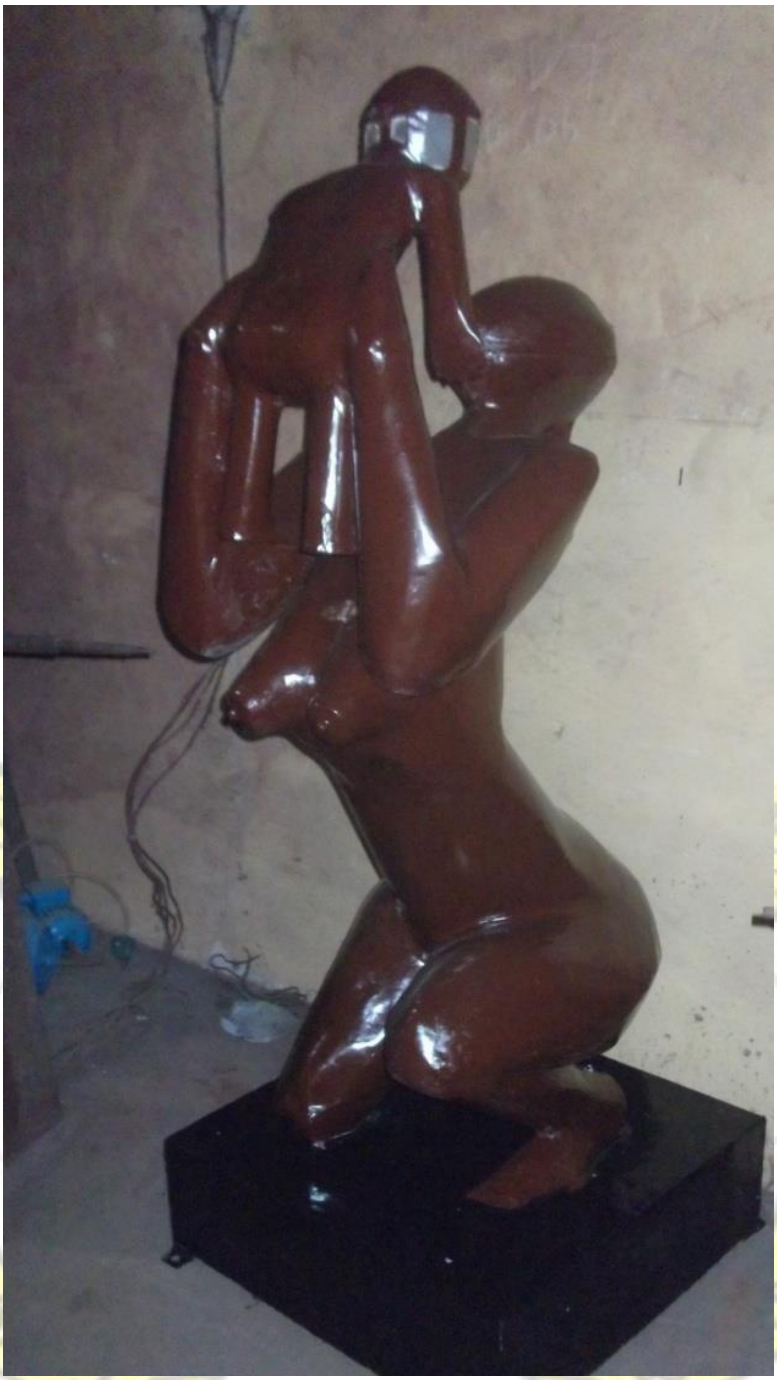

Fig. 3.118 The finished second statue.

3.7.1: Bill of Quantities

The cost of materials stated on the table below includes almost all the accountable items purchased either to be used directly in the fabrication processes or for the preparation of other materials used for the project. The money used for the repair or purchasing of components that facilitated the research and the studio work and finally the printing and photocopying of the draft report and the actual project report were included on **Table 1.1.** The table below shows the detailed cost of materials for the study.

Table 1.1: Details of the Cost of materials

QUANTITY	DESCRIPTION	UNIT PRICE	AMOUNT (IN GH₵)
4 Pieces	Steel sheets	95.00	380.00
2 Gallons	Turpentine	15.00	30.00
5 Pieces	½″ Steel rods (serrated)	20.00	100.00
10 Pieces	Flat bar	20.00	200.00
5 Packets	3.2mmE6013 electrode	30.00	150.00
4 Litres	Flamingo oil paint	30.00	120.00
3 Buckets	Metal filler	70.00	210.00
4 Metres	Sandpaper	5.00	20.00
2 Discs	Grinding disc	15.00	30.00
1 Piece	Electrode holder	15.00	15.00

5 Metres	Welding cables	12.00	60.00
1	Repair of welding machine	50.00	50.00
Drafts + 3 Copies	Project report	600.00	600.00
	Transport fares	200.00	200.00
2 Cans	Hardner and Clear	45.00	90.00
20m	Flexible PVC PIPE	10	200.00
	Electrical accessories	275	275.00
TOTAL			**GH₵ 2730.00**

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF FINDINGS

4.1.1: Introduction

There were several activities carried out from the beginning to the end of this research of which some were tried and tested later in the course of the research. Some of these were corrections, suggestions and new ideas which served as afterthoughts that were introduced one way or the other into the main work. This chapter is therefore going to highlight the identifiable tests and their possible results, how the study was able to assess the end results of the various solutions that were implemented and the general perception of both the researcher and observers as far as the two artifacts were concerned.

4.1.2: Findings

The decision at the beginning of the project was to fabricate the statues with steel sheets which were 1.25mm in thickness, but after purchasing the steel and then fabricating the armatures, there was a discussion on the fragmentation process of metal sculpture fabrication and 1mm steel sheets were found to be more malleable and could bend easily. The 1.25mm sheets were changed for 1mm sheets which cost less and which reulted in getting an additional 1mm sheet to bring the quantity to three of the 1mm sheets. Cutting and bending were easier and the welding though not very easy,wassmmoth and faster as filler rods were used which made welding smooth and faster.

Though the research was not really focused on reduction of weight, the researcher used more flat bars and ¼″ rods during the fabrication of the first statue. More 12mm iron rods than flat bars and 1/4″ rods were also used to fabricate the armature for the second statue which then rendered the second statue heavier than the former. After comparing the weight of both artifacts, the rate of overlapping was reduced and the templates as was done in the former and some of the supporting 12mm rods were cut off from positions where they could have obstructed the fabrication processes on other parts of the statues and also during light fittings. This practice helped to control the weight of the second work greatly. Based on the size and the posture of the second statue, one can conclude that its weight is far less than one could think of a metal statue of that size.

Another test was also conducted on the width of the sides of the mother figure in the first statue. Here, a comparison was done in relation to how proportional that part was as compared to the entire figure. It was found out that the width was not very proportional to the main body hence, that part was fabricated again, but this time a little wider than it used to be and it became more appealing to the researcher and his critics than the previous version. Changing the width at that point did not in any way alter the feminine shape of the statue, but rather provided a better space for the fitting of the baby figure and the abstractly designed cloth that covered the torsos of the two bodies.

After correcting the sides stated in the previous paragraph, it was also noticed that the supposed head of the same figure was also too small for that body size and the 1/4″ rods used in fabricating the armature were not very well positioned to support the templates

during the body building work and welding. The head was fabricated again, but this time, with better arrangement and its size was also made more proportional.

The head of the second figure was also found to be more lowered at the occipital making the imaginary eye-to-eye contact between the mother and the baby not very well on target. To pass this test, the researcher had to detach the head of the mother figure from its neck, raised it to the right angle, and then joined it back onto the neck. The results were better and the objective was achieved.

The patterns for the back of the heart-shape which also served as the buttocks of the mother figure in the first statue were cut large enough to cover one half of the buttocks, and so were the templates. Later when it was found out that welding them directly onto the armature could be impossible, they had to be fragmented based on the divisions done at the buttocks with the curved 1/4″ rods. This made welding very easy and also created easy flow of the overlapping templates and helped the proper creation of the heart-shape, especially on the right lower side.

The actual design was supposed to comprise only the bust of the baby figure wrapped in cloth on the right side of the mother's chest and was supposed to be fabricated as part of the main body, but upon second thought, the researcher decided to fabricate it differently and then welded at its position. This was done and it was very successful. Afterwards, the supervisor of the project thought it could be very appealing if the baby figure had been with parts of its legs and buttocks protruding out of the assumed cloth. That was also done and it gave the work a better look.

During the filler application process, there were parts of the work which were not very accessible to the researcher due to the distance between the mother and the child. Areas such as the chest of the baby, its chin, the front part of its neck and the mother's armpit closer to the baby's chest, were all filled by dipping the finger into the filler and then applying it at those places. Sanding was also done with sandpaper and the bare hand. This did not really help to achieve a better smoothness as compared with the other exposed areas, but was better and could receive the colour. The defect could only be seen at a very close observation.

Fixing of the abstractly coiled hair at the occipital of both the mother and the child, were also a test of the researchers signature. It was also an afterthought, but one would bear the researcher out that the actual beauty of both female statues could be clearly identified in the unique style of hair that they possess. This would make it easy for everyone to identify works, especially female sculptures made by this particular researcher.

The head of the second artifact, due to its function and symbolism, had to be cut into two and a hinge fixed for it. When that was done, it was noticed that the joint was not running through it smoothly, therefore the researcher had to use a metal strap to band the datum and spot-welded it in such a way that it could overlap the lower part of the opened head. This technique worked, but it became perfect when both halves were fillered together and a thin knife forced into and run through the joint to separate both halves a few seconds when the filler was about halfway dried.

During fabrication of the baby figure of the second statue, its legs became somehow cubic and did not make welding work look good. It was quickly noticed that the finishing processes on that part was going to be very difficult. In order to enhance proportionality; the fabrication processes had to continue till the completion of the entire work on this statue. Later the two legs were formed manually out of tubes and oval shapes of metal which were also proportional to the body of the baby, cut off the previously cubic legs, fixed the tubular legs and then welded them perfectly and this correction gave the figure a very good finishing.

The head of the baby figure of the second work which was going to house the reflected light was also cut in three-quarter up for the top part to function as the lid (cover), but the whole head was found to be too small and that the ¼″ rods supporting the lid were too small to house the reflectors. To avert this situation, 3/4″ flat bars which were about half more than the length of the rods and were measured based on the height of the electric connection, were used to replace the ¼″ rods. This change also worked perfectly and the problem with electric fittings was solved.

There were a few folds, exposed welded joints, dents and crooked areas due to the pressure from the cold forming tools. These were also resolved with the application of filler which made the entire work look like a unit without any seam and all these tests and their solutions contributed to a better project.

4.2: EVALUATION

4.2.1: Appreciation of the Finished Work

This study had summarised the appreciation of this project since most of the variables have already been discussed in the previous chapters and so need only a highlight of them at this stage.

The artifacts were both produced under one theme; semi-abstract metal sculpture on the theme 'Reflections of Affection'. The researcher was the designer, fabricator and the finisher of the artifacts. The entire project was undertaken within two academic years. It started in August, 2013 and was completed in July, 2015. The actual fabrication period for both artifacts span for six months, though fabrication was done at regular intervals with time.

The size of the first statue was 65cm by 62cm by 143cm (length, breadth and height respectively). The second statue was also 69cm by 62cm by 168cm (length, breadth and height respectively). The media of fabrication were different types of steel forms: iron rods, ¼ rods, flat bars, angle bars and steel sheets. These artifacts would be located at the Metal Product Design Section of the Department of Industrial Art, College of Art and Built Environment, Kwame Nkrumah University of Science And Technology, KumasiGhana.

The inventory of items in this project work and the description of technical qualities had already been taken care of in chapter three under materials and tools.

This project is a conceptualization of social, physical, moral, and psychological exposition. As has already been discussed earlier, the abstract female figure which symbolically has a lower heart-shaped body depicts selflessness, submissiveness, commitment and affections our mothers had for us when we were young and even as adults.

A mother breastfeeding her baby girl and then having her eyes close on the baby shows the kind of affection and how mothers mean business at the time when they want their babies to grab and reflect what the they want the babies to imbibe into themselves so as to reflect them in future. The hairs of both the mother and the baby have been plaited and a stretch of hair tied at the occipital. It was to give the figures a touch of an African woman's hairstyle and also to make the figure, though abstract, have true feminine appearance.

The cables transferring power into the medium of reflection (bulb) pass through the body of the mother. This means that for every child to be able to reflect some attitudes, behaviours and characters in life, all such trainings are channeled through the parents. The little girl in this statue is reflecting what has been transferred from her mother into her on top of the head and this portrays how the training that the mother is giving her would be reflected in her future life. The kind of affection the mother has for the child is also being portrayed in how the only protection against rain and direct sun rays; the umbrella, is protecting the child while the mother herself has been exposed to the mercy of all kinds of weather conditions.

The first artifact had its switch connected at the back of the platform. This symbolically stands for the hidden moral treasures of the mother which the child is expected to reflect in future. The abstractly wrapped cloth around the baby and the firm grip of the right hand on the baby also show how protective mothers are in ensuring the safety of their children.

The second statue which was also a semi-abstract female figure kneeling sportive and stressfully on her right leg with the left leg in a somehow squatting position, symbolizes her submissiveness, zeal, commitment, and affection for her child. Raising her baby boy of about one and a half year up and also having eye contact with the baby, shows how mothers uphold and hail their children. The way the mother is staring at the child shows how she might be reflecting on the agonies she might have gone through before or during delivery and how she would like to nurture this baby to become someone better in future.

These statues are likely to bring some relief to women in general. They seem to impact on the psychic when observed, and serve as good images for art therapy.

The second work also has a switch inside the head of the mother figure that transfer the electrical current from the mains to the head of the baby figure. This symbolically means that, though our elders say 'human heads are not like coconuts to be slatted for everyone to see the content', this mother is affectionately showing that she has a store of knowledge and wisdom at the disposal of her baby. The switch connected right inside the head (the brains) of the mother will trigger the reflection through the bulb in the head of the baby.

This signifies the fact that every child is a reflection of his or her parents' personality, whether negatively or positively.

The head of the mother figure was sealed half way inside because of its symbolic function. On top of that seal was connected the switch that would make it possible for the baby's head to reflect the affections that the mother proverbially wanted it to portray. The possibility of such a connection answers the analogy that most decisions taken by children and for that matter, humans, are informed or influenced by the thoughts of our parents, especially mothers.

The head of the baby figure which houses the bulb has been provided with a hinge at its occipital and an internal locking device which allows for opening and closing when there is the need for a change of bulb. The mother figure has also been provided with a hinge at the chin and a knob on top of the head to allow for opening and closing during switching on and off of the light. It also has an extension of the hair tied at the occipital which hangs vertically down. As a signature of the researcher's works, the tying of the hairs is similar in both figures.

A critic may want to know why the female figures were mounted on square platforms. It is imperative that apart from the Virgin Mary, no woman born of another woman has been able to bear a child without a man's effort, whether directly or indirectly. It is also true that square and rectangular shapes represent male figures so the researcher opted for a masculine support or platform to seal the proverb in Akan which says that *'sɛ ɔbea tɔ tuo a, ɛtwere Ɔbarima dan mu'*; translated as 'when a woman buys a gun, it is kept in a man's

room'. This means the man is the overall boss of whatever a woman owns including her affection, hence a man is the architect or the greatest supporter of a woman. This is why the male form serves as the support for these two female figures. Without a man, no woman can bring forth a child that would be expected to reflect her thoughts in future.

The general perception that toddlers most of the time dirty and fold their mothers' clothes have been depicted in the finishing of these artifacts and during the filler work. Certain parts of the painted figures may appear not very well finished. Those parts depict the concept of dirty and folded dresses of both the mothers and the children.

4.2.2: Assessment of Achievements

One cannot deny the fact that there were a lot of challenges in the course of this studiobased research and project execution, but in totality, it can boldly be said that the outcome of this studio-based research and the practical work have been successful though may not be perfect. The researcher still believes that the few imperfections in this project may even pave way for other researchers to also build upon and improve such areas of academic and research efforts.

The preliminary designs leading to the final blue print were eighty five and six out of that number of drawings were endorsed though only two were to be fabricated. Designing was also done within schedule and the assessment of the final design was also on time. It is believed that it is worth noting that in art work, afterthoughts may be welcomed provided

they would not alter the main design significantly. In view of this, it is believed that the little additions in the final work is permissible.

Considering the entire project work; from the building of armatures through patterning, templating, fabrication, welding, grinding, filler work, sanding, light fittings and spraying of the final work, one would humbly trust that the research questions have been properly answered, objectives have been achieved and the importance of the project has also been successfully attained, even though it is believed that critics and experts in the field would be the best judges.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1.1: Summary

The researcher at this stage of the research would like to share his joy after this very tedious and time consuming but patiently executed research work. The work comprises two semi-abstract sculptures on the theme**: 'Reflections of Affection'.** The research led to the designing and fabrication of two statues in the form of mother and child figures. The first figure depicts a seated figure symbolically breastfeeding her baby while imparting knowledge and affection through eye contact. The second figure comprises a squatting

mother affectionately tossing and playing with her baby while imparting moral lessons through kneeling on one leg and the other leg in a somehow squatting position and showing eye contact.

The write-up comprises five chapters with the first chapter dealing with the introduction which provides highlights on definitions of sculpture, their religious and historical background, the types of sculpture and the materials used for the fabrication of the works. The chapter also discusses the statement of motivation, which is specifically about the various factors that influenced or prompted the selection of this topic or the area of research. An objective of the research which deals with what the researcher intends to achieve was highlighted here.

There were also research questions which served as guidelines on how to achieve the set objectives, delimitation, which is about the parameters of the research, was part of this chapter. Things that could serve as obstacles to easy research work which are mostly refer to as limitations were outlined. Facilities available, methods to be adopted in doing effective research, importance of the research and budget estimate for the research were all highlighted in this chapter.

The second chapter of this research comprises a review of selected literature on the topic at hand. Here, the study searched, compared, contrasted and commented on selected materials which other researchers had put across as far as topics or similar projects were concerned. Some of the selected areas reviewed were the definition of welding, types of welding, some essential tools, equipment and machinery for welding, definition of metal fabrication, the

history of metal fabrication, some metal fabrication techniques, history of sculpture, types of sculpture, mother and child sculpture, abstract metal sculpture and the importance of mother and child statues.

Chapter three of this project comprises the research methodology which entails the research designs adopted for both the theoretical and the practical aspects of the project. These were descriptive research and studio based research. The libraries which served as the sources of written information were also outlined in this chapter. There was a discussion on the subject matter which was on a symbolic metal lighting sculpture on the theme 'reflections in affections', the researcher also described most of the materials and tools which were used in executing the project and how best they were applied in the research. The researcher also described how sketching, designing and rendering were successively done and portrayed figures of some of them in the research. Preparation of materials for the research was also described in this chapter.

This study had systematically described almost all the chronological processes followed in the fabrication of the two sculpture pieces with images that vividly describe every stage of the fabrication processes, in the chapter four of the research. After the fabrication processes, an appreciation of both works was also done in order to make the work better understood by all who may one way or the other come across these artifacts.

5.1.2: Conclusions

In Conclusion, one would agree with the analogy that, ‘whatever goes up must automatically come down one day’ and also ‘everything that has a beginning has an end’. The researcher would like to thank God and congratulate all who contributed one way or the other to make this research a success. This research has proven without doubt that it has been a very challenging project most especially where a researcher has to come from a different section to embark on a project more related to the sculpture department, but the experience and the expertise gathered have been very much worth the effort.

This study has been able to highlight on a lot of possible avenues of welding different sizes, shapes and thickness of metals and the effects that were identified with the use of such materials. The issue of lack of welding and other fabrication facilities at the Metal Product Design Section has also been given prominence by solemnly appealing to stakeholders for assistance.

The various fabrication techniques applied in this research which include the ‘fragmentation sheet metal technique of fabricating metal sculpture’, the folding, bending, twisting, stretching, cold metal tube forming technique coupled with the Arc welding technique, made it very evident that this research had really given greater experience that could be applied in order to reduce the timeline for any future work of this kind. It had also put this research in a better position in terms of consultation and sharing of ideas with other researchers who may want to do similar works in future.

Finally, the systematic way of arranging the facts and figures in this research, the kind of finishing given to the artefacts and the content of the vivid appreciation given on the proverbial, symbolic and the moral values of these artefacts, go a long way to educate students, other artists, art critics and the general public on how this research has been able to add to knowledge and academia.

5.1.3: Recommendations

It is believed that this research will go a long way to prove to other sculptors, metalworkers and lovers of figurative and functional works that exterior sculpture pieces are not always supposed to be static and decorative, but can also be mobile and functional.

It is therefore recommends that metalworkers should try as much as possible to venture into the designing, fabrication and the business aspect of metal sculptures since most of such works sell better than other metal artifacts.

Most second cycle schools need proverbial and symbolic monuments in this country, but some may not be in the best financial position to afford metal statues. It is therefore the wish in this study, that Metalwork students pursuing Masters and PhD would consider taking up project works of this kind and then mount their works, may be free of charge, in those schools. At least the artist would feel proud when people have to travel to such destinations to have a look at a work done by such artists. This would also serve as a means

of advertising the artist, his works and the institutions and may also offer the artist more contracts in the near future.

A solemn appeal is being made to the Kwame Nkrumah University of Science and Technology that, since they are the only and unique institution in Ghana offering Metal Product Design programme at the first degree level and Jewellery and Metalsmithing at the MFA level, welding and other fabrication facilities should be provided for the section to be well equipped to effectively produce students capable of improving upon metalwork at all levels of our educational ladder and also for the mining and the oil company artisanal works here in Ghana.

The lighting functions should be considered in mounting these statues. The study humbly recommends positioning the artifacts closer to a source of electrical power for easy connection. It is also recommended that 1.5mm cables should be used for an extension of the switch closer to the location of the artifacts.

Arc welding is one of the best techniques for the fabrication of metal sculpture pieces that require the use of armatures. MIG and TIG welding may work out very well for sheet welding without armatures depending on the thickness of the sheets.

It is also recommended that when welding thin and thicker metals together, the welding torch or electrode should be focused on the thicker metal which would take a longer time to melt so that it would easily fuse with the thinner metal.

Cold metal forming is very difficult and require special skills so it is therefore recommended that when fabricating a curved shape in cold metal of 1mm or more in thickness, to cut the metal into segments and then join them individually to one another otherwise the curves may not form properly.

Rigid armature is sometimes needed unless the metal is a plate or a thicker sheet that can easily be joined together still get a strong structure and a rooting mechanism would also be very important to prevent the figure from tipping over in heavy storm.

When handling normal size human figures that are in a particular posture other than standing, it is advisable to treat the sides and the buttocks as the last to be welded so as to allow the artist join certain hidden places that would be very difficult to access from the outside. Metal sculpture may abound in the near future and for that matter, it is recommended that every metal fabricator has a signature that would be very peculiar to only his works and render him or her distinct.

It is recommended that this project work be mounted at a public location where it would attract visitors and tourists in order to achieve the researcher's aim of making the Metal Product Design Section much more popular and for future orders.

It is finally recommended that other metal sculpture fabricators learn to produce sculptures that come with platforms such as these in order to avoid extra expenses that would be incurred in constructing platforms for every single statue and also make the sculptures

mobile or portable. The study therefore advises that these statues are not made to serve as objects of worship in any form. They are made only for decorative, lighting purposes as well as for future commercial purposes.

APPENDIX I

REFERENCES

1. Anne M. (2014), Some Advanced Techniques For Sheet Metal Fabrication. Retrieved from http://www.wamda.com/annemehla.
2. Barbara A. Et al (1984), Ancient Near Eastern Art. *The Metropolitan Museum of Art Bulletin*, v. 41, no. 4.
3. Barton D. (2015), Scholastic, Retrieved from http://teacher.scholastic.com/activities/scholasticnews/index.html
4. Department of Ancient near Eastern Art (2004), "Early Dynastic Sculpture, 2900–2350 B.C.". Heilbrunn Timeline of Art History. The Metropolitan Museum of Art, New York. Retrieved from http://www.metmuseum.org/toah/hd/edys/hd_edys.htm.
5. Haynes J. h. and Storer J. (1994), The Haynes Welding Manual, North America, Inc. 1-6 & 2-21

6. Howard B.C (1998). Modern Welding Technology, 4th edition, Prentice-Hall, from the Training Materials Dept., Hobart Institute of Welding Technology 400 Trade Square East, Troy, OH 45373.Linacre House, Jordan Hill, Oxford OX2 8DP, UK, Burlington, MA 01803, USA, 467-519.
7. Marcoe M. (2014), Mining Equipment Repair Mackay, Retrieved from http://myhou.org/tag/mining-equipment-repair-mackay.
8. Marshall C. (2010), A Research Design for Stiudio-Based practice, A Central Connecticut State University.
9. Matt M. (2014), Sheet Metal Fabrication: Basic Machines & Techniques. Retrieved from http://www.easttwood.com/blog/caterory/eastwood-chatter.
10. Mbiti, Et al (1969), maternity figures in African culture, online exhibition of maternity figures from various cultures in Africa.
11. Rangwala (2008), Material Science, MacMillan Ltd, 124-136.
12. Timings R. (2008), Fabrication and Welding Engineering, Elsevier Ltd.Elsevier.
13. Untracht O. (1982), Jewellery Concept and Technology, Garden city, New York, Doubleday.