

A STUDY OF WORKS PRODUCED BY METAL PRODUCTS DESIGN STUDENTS
OF FACULTY OF INDUSTRIAL ART, KNUST

By

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DECLARATION

I hereby declare that this submission is my own work towards the MA 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 of the University, except where due acknowledge has been made in the text.

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ABSTRACT

This study aimed at investigating and appraising works produced by students of Metal Products Design of Faculty of Industrial Art, KNUST. The research was intended to find out about the strengths and weaknesses of works of students and the future direction of works to be produced by students of the section. The data for the study were collected from both primary and secondary sources. The primary sources of data were gathered through administration of questionnaires to students from year two to year four and the lecturers of the Metal Products Design Section. The secondary sources were from books, journals and internet. Selected works of students from the year 1999-2009 were purposefully sampled. Appraisal on the works were conducted. The study discovered the significance of Metal Products Design in our society. It identified what makes up the Metal Products Design and the type of works produced at the section. The research also found out whether the works were students produced works or commercial works. Again whether works were metal art or artisan works and to what extent were the works relevant to our country. The study recommended immediate introduction of industrial attachment and welding course for students, improving of equipment and tools, increasing lecturer per student ratio and immediate department status for the Metal Products Design Section were some of the major recommendation made.

N.A.T

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

In 1964, Metal Products Design Programme (MPDP) was introduced in Kwame Nkrumah University of Science and Technology. The establishment of the MPDP was to contribute to effective utilization of precious and non-precious metal in Ghana.

Although the MPDP was started by a German metal artist, the objective was to improve the metal art industry in Ghana to meet the growing need of the country in both artistic and quantitative way.

Notably, before the introduction of the MPDP there were metal works produced by artisans who were serving the metal industry in this country. The introduction of MPDP was to establish excellence in the metal art industry. The goal was to train students to be efficient in metal technology and to differentiate between art and artisan works. This means students should be able to combine metal art and metal work to produce formidable metal product design works.

The four year programme has the following breakdown. In year one, general courses are taught. In year two, students are taught jewelry work and decorate work. The third year sees to it that students produce works related to jewelry and fabricate metal. In the final year, students are given the choice to choose among jewelry, decorative work and metal fabrication work. There is one exception at the MPD section. That is, in final year, students are expected to combine all that have been taught from year one to four to produce a project work. This means more often, students produce works that exhibit proficiency of metal technology and metal art.

Without a studio and a workshop, students of Metal Products Design are making use of the few equipment and tools at the section. Although space has become a problem for students at the Metal Products Design section, there are other challenges. These include increasing number in student intake, insufficient supervision due to the unfavourable student- lecturer ratio and lack of funds to provide materials such as gas and palm nut cover which aid students to fashion their works.

In this light, the researcher wants to find out the strengths and weaknesses of students' works and what should be expected of works of students in the future. Also the researcher will look at what can be done to help students in their works.

1.2 Statement of the Problem

Metal Products Design (MPD) is the creative ability to use metal to produce functional and ornamental items. As a developing country, metal products design has helped to make use of our metal substances such as gold, brass, copper and others.

In Ghana, the MPD has a lot of functions. These functions have contributed a lot in our society. For instance, from our traditional to modern homes, we see metal products design. A Ghanaian kitchen can boast of metal products design such as sauce pan, tea strainers, spoons, laddles, plates, forks, knives, coalpots, just to mention a few. One cannot forget about our sitting rooms and bedrooms which are decorated with metal chairs, mirror frames and television stands.

In addition, Ghanaian houses most of the time have metal gates with intricate designs. The windows and the door frames of some houses are all works of the metal products designer. In the hospitals, patients' beds, tools and medical equipment are mostly made of metal. Offices in Ghana have metal chairs, metal cabinets, metal desks

to serve as rest for computers and metal clips for clipping. Institutions, churches and other organizations also make use of metalworks like chairs, tables, podium, watch frames and incense burners.

In the case of jewellery, necklaces, rings, bracelets, ear rings, cufflinks, tie-pins and hair pins are used by individuals to beautify themselves on occasions and daily activities. In our palaces, the chiefs are royally dressed and adorned with jewelleries which are metal products design.

It is obvious to note that metal products design is now one of the major contributors to all areas of human needs. It is in regard of the growing need for MPD that in 1964, KNUST introduced the programme. This programme which awards Bachelor of Art degree (Industrial Art Metals) was to help meet the growing need of MPD in the country. Although jewellery is important in our society, it seems the MPD section is noted for its production than any other metal work. As of now the students in and outside the University who know the MPD section classify it as Jewellery section. One can clearly state that the name MPD means more than the works being produced at the Section. The works that MPD can produce for use in the home and office of Ghanaians as viewed in the direction of works produced at the MPD Section of KNUST indisputably raise a lot of questions in the minds of people. This means that there is a problem of what KNUST MPDP is all about especially works produced by students. Since the section is known for producing jewellery works more than the other MPD works, students produce limited kinds of work and one cannot tell whether the works are art works or artisan works.

It is in the light of this problem that the researcher wants to take a study of works produced by the students of MPD section to educate the public about works of students, what the works of students entails and the future direction of students' works.

1.3 Objectives

1. To identify and describe selected types of works produced by students of MPD section.
2. To discuss the sources of ideas, processes, tools and materials and equipment used by students to produce their works.
3. To appraise selected types of works produced by students of the MPD section to ascertain their strengths and weaknesses.

1.4 Research Questions

1. How will the study identify and describe selected types of works produced by students of the MPD section?
2. To what extent will the study discuss sources of ideas, processes, tools and materials and equipment used by students in executing their works?
3. To what extent will the study bring out strengths and weaknesses of students' works at the MPD section?

1.5 Delimitation

This research is limited to selected works fashioned by students of MPD Section of Faculty of Industrial Art of KNUST from 1999/2000 to 2008/2009 Academic year.

1.6 Limitations

The researcher encountered some problems. First, one lecturer at the MPD section could not respond to the questionnaire though the questionnaire was collected. Again, some lecturers did not make themselves available to respond to interview though interview guide was given to them before hand.

Some students also did not answer all the questions in the questionnaire while others took them to their hostels and did not return them. Some of students' works kept in the store room were nowhere to be found. The researcher had to do with the remaining works of students in the store room.

1.7 Importance of the Study

- The study would bring into focus the trend of works produced at the MPD section and its impact in the metal industry.
- The study would help enlighten the University authorities and lecturers on the scope of strengths, weaknesses and the future direction of MPD section.
- It would also serve as wake up call for the MPD section by updating the section about the scope of strengths, weaknesses and the future direction of the MPD section.
- The thesis would add to the existing knowledge on MPD works at the metal products design section.
- It would also serve as a source of reference for further studies to future researchers, writers and publishers and the metal products designers.

1.8 Definition of Terms

- Metallurgy* :Is the science and technology of metals, including the extraction of metals from ores, the preparation of metals for use, and the study of the relationship between structures and properties of metals.
- Jewellery* : Is ornaments of precious metals, sometimes set with gems, worn since ancient times by people of all cultures for personal adornment, as badges of social or official rank, and as emblems of religious, social, or political affiliation.
- Malleable* : Describes a metal or other substance that can be shaped or bent without breaking.
- Ductile* : Ability to draw out metal into wire or hammered into very thin sheets.
or to be able to mold or shape metals without breaking
- Blacksmith* : Is one who forges and shapes metal with an anvil and a hammer.
- Metalsmith* : Somebody who is skilled at making and repairing metal objects
- Silversmith* : Somebody who makes or repairs silver or silver-plated objects
- Tinsmith* : A maker or repairer of objects made of tin or other easily worked metals.
- Welding* : A process in which two or more pieces of metals are joined together by the application of heat, pressure, or a combination of both.
- Alloy* : A substance composed of two or more metals. Alloys, like pure metals, possess metallic luster and conduct heat and electricity well, although not generally as well as do the pure metals from which they are formed.

Electroplating: Electrochemical process for depositing a thin layer of metal on, usually, a metallic base.

1.9 Abbreviations

MPD:	Metal Products Design
IAMPD:	Industrial Art Metal Products Design
MPDP:	Metal Products Design Programme
KTI:	Kumasi Technical Institute

1.10 Organization of the rest of Text

Chapter one is about the introduction which constitutes the background to the study, statement of the problem, objectives, research questions, delimitation, limitation, importance of the study, definition of terms, abbreviation and organization of the rest of the text.

Chapter two deals with the review of related literature. This include, appraisal, aesthetics, definition of Metal Products Design, history of metal working, common metal, equipment and tools used in metal products design in Ghana, some metal works and their uses in the Ghanaian culture, some working techniques in Metal Products Design, Fundamental processes involved in working metal and designing of metal work.

Chapter three focuses on the methodology which comprises the following: research design, library research, population for the study, sampling, data collecting instruments, primary and secondary data, reliability and validity of data and information, data collecting procedures, analyzes and interpretation of data.

Chapter four is the presentation and discussion of findings.

Finally **chapter five** spelled out the summary, conclusions and recommendations.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Overview

This chapter concentrates on reviewing relevant literature on the topic. It deals with information given by some authors which has bearing on the topic. Since the topic is about works produced by Metal Products Design students, the researcher reviewed literature that is related to the topic and how approaches to the topic have changed over time to find out whether the study would give the scope, strengths and weaknesses and future direction of the programme in KNUST. For the purpose of this review, the researcher concentrated on the following sub-topics:

- Appraisal
- Aesthetics
- Definition of Metal Product Design
- History of metalworking
- Common metals used in metal products design in Ghana
- Common equipment and tools used in Metal Products Design in Ghana
- Some Metal works and their uses in the Ghanaian culture
- Some working techniques in Metal Product Design
- Fundamental processes involved in working metal
- Designing of metal work

2.2 Appraisal

According to Scherer (2001), appraisal consists of the following:

1. A decision-making process:
 - *Appraisal (decision analysis)* - a decision method
 - *Project appraisal* - comparing options to deliver an objective
 - *Economic appraisal* - an appraisal based on comparison of monetary equivalents
2. Property Valuation
 - *Real estate appraisal* - the practice of determining the value of real property
 - *Domain appraisal* - the act of evaluating the worth of a specific domain name, such as Google.com.
3. Other
 - *Appraisal theory* - a psychological theory of emotion and cognition
 - *Archival appraisal* - process for determining which records need to be kept and for how long.

Out of the three components of appraisal, the researcher used the first component in the study. This is because it involves analysis and comparison to deliver objective idea.

There are different stages of appraisal model. These are decision model and appraisal theory.

2.2.1 Decision model

A decision method is an axiomatic system that contains at least one action axiom. Formulation is the first and often most challenging stage in using formal decision methods and in decision analysis in particular. The objective of the formulation stage is to develop a formal model of the given decision.

Evaluation is the second and most algorithmic stage in using formal decision methods. The objective of the evaluation stage is to produce a formal recommendation and its associated sensitivities from a formal model of the decision situation. Appraisal is the third and last stage in using formal decision methods. The objective of the appraisal stage is for the decision maker to develop insight into the decision and determine a clear course of action. Justifying a decision model is the action of exploring and explaining the reasoning that led to the formulation of a particular decision model.

Mining as a decision model is the action of extracting information like sensitivity, value of information, and value of control) from a given decision model.

2.2.2 Appraisal theory

Reasoning and understanding of one's emotional reaction becomes important for future appraisals as well. The important aspect of the appraisal theory is that, it accounts for individual variances of emotional reactions to the same event (Lazarus, 1990).

Appraisal theory is the idea that emotions are extracted from our evaluations of events that cause specific reactions in different people. Essentially, our appraisal of a situation causes an emotional, or affective, response that is going to be based on that appraisal. An example of this is going on a first date. If the date is perceived as positive, one might feel happiness, joy, giddiness, excitement, and anticipation, because they have

appraised this event as one that could have positive long term effects, i.e. starting a new relationship, engagement, or even marriage. On the other hand, if the date is perceived negatively, then our emotions, as a result, might include dejection, sadness, emptiness, or fear (Scherer, 2001).

2.3 Aesthetics

Kaelin (1989) argues that aesthetics, like most other intellectual disciplines, had its beginnings in the speculations of the Greeks on the nature of things and ideas. Aesthetics or esthetics is the study of sensory or sensori-emotional values, sometimes called judgments of sentiment and taste.

More broadly, scholars in the field define aesthetics as critical reflection on art, culture and nature. Kaelin (1989) further explained that aesthetics is a subdiscipline of axiology, a branch of philosophy, and is closely associated with the philosophy of art. Aesthetics studies new ways of seeing and perceiving the world.

Hein & Korsmeyer (1993) purported that aesthetic expands the range of what we consider to be art and prepares the way to legitimate new art forms; opens the community of artists; revalues subjectivity in art and augments to include women's experiences; allows us to reconnect aesthetic values with political activity; stimulates criticism of obsolete aesthetic standards and validates new ones; valorizes new modes of production; and supports more active response.

2.3.1 Aesthetic judgment

Judgments of aesthetic value clearly rely on people's ability to discriminate at a sensory level. Aesthetics examines affective domain response to an object or phenomenon. Many see natural beauty folded within petals of a rose.

Viewer interpretations of beauty possess two concepts of value: aesthetics and taste. According to Edusei (1991) aesthetics is the philosophical notion of beauty. Taste is a result of education and awareness of elite cultural values; therefore taste can be learned. Taste varies according to class, cultural background, and education. According to Kant(1790), beauty is objective and universal; thus certain things are beautiful to everyone. The contemporary view of beauty is not based on innate qualities, but rather on cultural specifics and individual interpretations.

2.3.2 Aesthetics and the philosophy of art

Aesthetics is used by some as a synonym for the philosophy of art, while others insist on a distinction between these closely related fields. Adu-Agyem(1990) pointed out that, in practice aesthetic refers to the sensory contemplation or appreciation of an object, while artistic judgement refers to the recognition, appreciation or criticism of art or an art work.

Kaelin (1989) as affirmed by Fosu (1993), opines that aesthetic art has always been an institution of society, more or less free, more or less controlled as are the other institutions of a society, yet always serving to unite people into a single appreciative audience.

Smith (1966) was of the view that in sum, the aesthetic exists not merely where unity is an experience, and where this unity is incorporated in immediate qualities but where there is a certain kind of act – an intuition, a seizure of the individual quality or pervading tonality of the immediate object and all that it incorporates.

2.4 Definition of Metal Products Design

According to Knauth (1974), MPD, as the name implies, is a division of knowledge, which deals with the general designing and how to put that design to use in metal or integrate metal.

MPD works include blacksmithing, jewellery, furniture, decorative pieces and other artifacts. Accepting this definition means the programme MPD should offer wide ranges of specialization to students who pursue the programme and this should show in students' works.

2.5 History of Metal Working

Metalworking had its beginnings in the past. At some imprecise point in the distant past humankind discovered that certain rocks now called ores could be smelted, producing metal. Further, they discovered that the metal product was malleable and ductile and thus able to be formed into various tools, adornments and put to other practical uses. Humans over the millennia learned to transform raw metals into objects of art, adornment, practicality, trade, and engineering (Knauth, 1974).

According to Knauth (1974), the recognition of metal and its uses started far back at the time of the Pharaohs in Egypt, especially in Africa. In some cases rules for ownership, distribution, and trade were created, enforced, and agreed upon by the respective peoples. By the above periods, metalworkers were very skilled at creating objects of adornment, religious artifacts, and trade instruments of precious metals (non-ferrous), as well as weaponry usually of ferrous metals or alloys. These skills were finely honed and well executed. The techniques were practiced by artisans, blacksmiths, alchemists, and other categories of metalworkers around the globe. For example, the

ancient technique of granulation is found around the world in numerous ancient cultures, before the historic record showed people traveled by sea or overland to far regions of the earth to share this process that is still being used by metalsmiths today.

There was progress in the need and use of metal as time went by. As time progressed metal objects became more common, and ever more complex. The need to further acquire and work with metals grew in importance. Skills related to extracting metal ores from the earth began to evolve, and metalsmiths became more knowledgeable. Metalsmiths became important members of society. Economies of entire civilizations were greatly affected by the availability of metals and metalsmiths.

More individuals than ever before are learning metalworking as a creative outlet in the forms of jewelry making, restoration of aircraft and cars, blacksmithing, tinsmithing, tinkering, and in other art and craft pursuits (Palmer, 2007). According to Safra (1998), Colonial America Silversmith in the New World in the colonial period is more or less derivative from Europe and England. In North America it was first brought to New England by English craftsmen in the 17th century. North American colonial silver is distinguished for its simplicity and graceful forms, copied or adapted from English silver of the period. On the other hand the colonial silver of Mexico, Brazil, Colombia, Peru, Chile and Bolivia shows a blending of Iberian or Spanish designs and focus on indigenous influences that trace back to pre-Hispanic times. Most of these relics survived in the churches as sacramental vessels: but there were some notable private collections.

Safra (1998), also indicated that metal works is a copied work by the Colonial Americans. North America started metal working in the 17th century of which other

countries joined them. They produced works for religious purposes, decoration and functional occasion. It also served as a big source of employment for them.

2.6 Common Metals used in Metal Products Design in Ghana

The most common metals use in the metal industry in Ghana includes gold, copper, silver, iron, brass and aluminum.

2.6.1 Definition of metal

The Cambridge Encyclopedia, Second Edition (n.d) is of the view that metal is an element whose solid phase is characterized by high thermal and electrical conductivities. Pure metals are all lustrous, opaque, cold to the touch, and more or less malleable. The large majority of the elements are metals, and metallic properties increase from lighter to heavier elements in each group of the periodic table and from right to left in each row.

Information in Cambridge Encyclopedia gives an account of the scientific meaning of metal. It also expressed the properties of metal which make it workable. Some of the properties are malleable, ductile, cold touch etc.

The most common metals known in Ghana and mostly used for metal works can be found in their native states, e.g., gold, silver, copper, iron (from meteors) and brass. However, the occurrence of these metals was not abundant and the first two metals to be used widely were gold and copper.

2.6.2 Gold

Ayensu (1997) elucidated that gold is the commonness precious metal used in Ghana. Gold forms the core nature of Ghanaian jewellery and wealth. Gold articles are

found extensively in antiquity mainly as jewellery e.g. bracelets, rings etc. The symbol for gold is Au from the Latin word 'aurum' meaning shining dawn.

According to Mortimer (1975) early gold artifacts are rarely pure and most contain significant silver contents. This led to the ancients naming another metal - electrum, which was an alloy of gold and silver, pale yellow and similar in color to amber. Therefore, early gold varied from pure through electrum to white gold.

Stone Age man learned to fashion gold into jewellery and ornaments, learning that it could be formed into sheets and wires easily. It is as a result of this that gold could be fashioned and used effectively in Ghana.

2.6.3 Copper

Copper is another important metal to the Metal Product Designer. It is also used for jewellery and furniture decoration in Ghana. The use of copper in antiquity is of more significance than gold; as the first tool, implements and weapons were made from copper.

According to Mortimer (1975) 4,000 to 6,000 BC was the period when copper came into common use. The symbol for copper is Cu and comes from the Latin word 'cuprum' meaning from the island of Cyprus. Initially copper was chipped into small pieces from the main mass. The small pieces were hammered and grounded in a manner similar to the techniques used for bones and stones. However, when copper was hammered it became brittle and would easily break. The solution to this problem was to anneal the copper. This discovery was probably made when pieces were dropped in camp fires and then hammered. By 5,000 BC copper sheet was being made.

Copper is reddish in colour, malleable, ductile and a good conductor of heat and electricity. Approximately 90% of the world's primary copper originates in sulphide ores.

2.6.4 Silver

In Ghana, the second precious metal use is silver. Although silver was found freely in nature, its occurrence was rare. Silver is the most chemically active of the noble metals, it is harder than gold but softer than copper. It ranks second in ductility and malleability to gold. It is normally stable in pure air and water, but tarnishes when exposed to ozone, hydrogen sulphide or sulphur. Owing to its softness, pure silver was used for ornaments, jewellery and as a measure of wealth. In a manner similar to gold, native silver can easily be formed. It is used for all kinds of rings, for electro plating just to mention a few. Silver's symbol is Ag from the Latin word 'argentum'.

2.6.5 Iron

Iron is use by Metal Product Designers for all aspects of metal works in Ghana. The commonly noticed ones are furniture, frames, car parts etc. Iron was available to the ancients in small amounts from meteors. This native iron is easily distinguishable, because it contains 6-8% nickel. There is some indication that man-made iron was available as early as 2500 B.C., however, iron making did not become an everyday process until 1200 BC. Hematite, an oxide of iron, was widely used by the ancients for beads and ornaments. It is also readily reduced by carbon. However, if reduced at temperatures below 700-800 C it is not suitable for forging and must be produced at temperatures above 1100 C.

2.6.6 Brass

In Ghana people wear jewellery which one may think is gold. Most of these jewellerys are made of brass. Ayensu (1997) pointed out that, this is possible because brass has a very fine colour and nature that resembles gold. Brass is an alloy of copper and zinc. Harder than copper, it is ductile and can be hammered into thin leaves.

The malleability of brass varies with its composition and temperature and with the presence of foreign metals, even in minute quantities. Some kinds of brass are malleable only when cold, others only when hot, and some are not malleable at any temperature. According to Redmond (2009), all brass becomes brittle if heated to a temperature near the melting point.

2.6.7 Aluminum

Aluminum is a brilliant, silvery-white metal. The chemical symbol for aluminum is Al. It is the third most abundant element and one of the most useful metals. Although aluminum costs four or five times as much as iron or steel, it weighs only about one-third as much, with a density of 2.7.

Aluminum is a good conductor of electricity and heat, and it reflects heat when highly polished. Aluminum melts at a temperature of 1220F (660C). Aluminum is obtained from alumina by removing the oxygen in alumina in a process called smelting. (In smelting, an ore is heated until it melts. Often a chemical change also takes place, and metal is separated from the ore). It is soft to work with in lamp production and also malleable and gives bright finishing.

2.7 Common equipment and tools used in Metal Products Design in Ghana

Equipment and tools use in the metal industry are both electrical and manual machines. In Ghana, the metal industry such as valco, domond uses the electrical machines while small scale metal company uses the manual machines.

2.7.1 Equipment

According to Woodbury (1972), equipment such as milling machine, guillotine machine, burning furnace, anvil, industrial casting machine, industrial drilling machine, soldering gas touch and cutting shear machine are some of the basic equipment needed in producing metal works

2.7.2 Tools

Some of the tools needed for metal product design include jewellery saw frame, jewellery saw blade, hand soldering touch, cutting shears, tweezers, files, pliers, scissors, hammer, mallet, punch, hand drilling machine, hack saw frame, hack saw blade, crucible and drill bit (Woodbury,1972).

2.8 Some metalwork and their uses in Ghanaian culture

Metal has a lot of uses in Ghanaian culture. It is used for body adornment, room and hall decoration and utensil.

2.8.1 Jewellery

Clare and William (2009), explained that, jewellery is an ornament of precious metal, sometimes set with gems, worn since ancient times by people of all cultures for personal adornment, as badges of social or official rank, and as emblems of religious,

social, or political affiliation. In Ghana, one of the most important uses of metal works is for jewellery purpose. It shows the people wealth and gives them beauty especially the women.

Ross (2002) in his collection observed that ring, bracelet, ear ring and necklaces are the mostly used jewellery in Ghana. Ross (2002) explained by citing Blake (1942) that “some of these women wear on their bare arms certain fore sleeves made of plates of beaten gold. On their fingers also they wear rings, made of golden wires, like a knot or wreath”. The account of Ross indicated that Ghanaians knew how to use their gold and other metal substances for jewellery before colonialism. They knew where to use them and the beauty purpose of using them.

2.8.2 Bangles

Sarpong (1977), assesses that, as large and impressive LeBel collection of bangles and other items of jewellery is the outcome of a challenge thrown to the Rev. A. R. LeBel about 1960. Father LeBel was the first Principal of St. John Bosco’s Training College, Navrongo, and at that time a Parish Priest in Bongo, in the Frafra Traditional Area of the Upper East Region in Ghana. At that time, he happened to come across a couple of bangles, and they steered him on.

Realizing this, Father LeBel felt that bangles should be given their rightful place among the different branches of art which have been created in Africa, and he started collecting. After ten years, his collection was probably the largest collection of West African bangles and related jewellery in existence, and indeed it probably remains so to this day.

2.8.3 Utensil

Cutlery, in general usage, is a term applied collectively to all types of cutting instruments. Specifically, it refers to utensils employed in the preparation and consumption of food (Redmond, 2009).

Spoon, fork, sauce pan, metal pot, ladle, frying pan, tea strainers just to name a few common ones are produced in Ghana by the Metal Products Designer for use in homes. Preparation of most Ghanaian dishes requires the service of cutleries.

2.8.4 Furniture

According to Schwartz (2009), furniture, is the usually movable article in a room. The movable aspects of it equip it for use. The most common pieces of furniture are beds, chairs, tables, and chests.

Metal Product Design has a lot of functions; one of them is using metal to produce metal furniture. In Ghana, iron together with other metals are used to produce works like chairs, tables, beds, mirrors frame, television stand and so on.

2.9 Some working techniques in Metal Products Design

The basic metal working techniques include embossing, matting, etching, oxidation, enamelling, repousse, engraving and chasing.

2.9.1 Embossing

According to Frank (2000), the free encyclopedia reviews that, embossing is a process whereby a design is formed on a metal by raising the design on the surface of the metal using hammer and chasing tool. This technique is employed in Metal Product Design to add to its aesthetic quality.

2.9.2 Matting, etching and oxidation

Other methods of surface decoration in Metal Product Design are matting, etching and oxidation. Matting, etching and oxidation is to impress it with repeating patterns of hatched lines (again, usually used on precious metals), thus matting or breaking up areas to contrast with other areas left polished and reflective. Yet another method of darkening selected areas is to etch them with acid, a technique mostly used on steel armor and the steel parts of weapons. In the 19th century a process called oxidization was devised; with it, a subtle darkening effect was achieved on polished silver surfaces with a pickling process using sulphur.

2.9.3 Enamelling

According to Palmer (2009), enamel is a vitreous substance fused by heat to objects of metal, ceramic, or glass. Enamel fused to ceramic or glass is called glaze. Enamel is also employed to enhance Metal Products Design that it adds more value to it. Enamel may be use on decorative objects, such as jewellery or vases, or on industrial products, such as bathtubs and kitchenware. It is chemically identical with glass, consisting of a mixture of silica (from quartz or sand), soda or potash, and lead. These ingredients are usually made opaque by adding other metallic oxides. Commercial oil-based paints that dry with a shiny, glasslike finish are also called enamel.

2.9.4 Repoussé

Another practice employed in Metal Product Design is repoussé. Decoration relies on the relative softness of metals. The early men probably derived this idea from the same beating processes employed for shaping, for it is possible to furrow or ridge metal by blows upon the surface (or, with sheet metal, from the underside); this gives the

pleasing effect of parallel ribs seen on copper cups and bowls, found, for instance, in the royal graves at Ur.

According to Frank (2000), more localized and selected hammering can raise anything from simple bosses to whole pictorial effects in relief. This technique, usually known as repoussé, has been used for over 4000 years; it reached its greatest elaboration in 16th- and 17th-century Europe on precious gold and silver utensils for church and domestic use.

2.9.5 Engraving/chasing

Explanation from Frank (2000), indicates that linear patterns can also be made on surfaces either by removing a narrow fillet of metal with a cutting or graving tool, or by depressing the surface with a blunt point and hammering along the line to be delineated without removing any metal. The former is called engraving and the latter chasing; these techniques are mostly reserved for precious metals.

2.10 Fundamental processes involved in working metal

Ralph (2009) explains that Metal Product Design is generally divided into three categories. These are forming, cutting, and joining. Each of these categories contains various processes.

2.10.1 Forming

Forming is a collection of processes wherein the metal is rearranged into a specified geometry (shape) by:

- heating until molten, poured into a mold, and cooled;

- heating until the metal becomes plastically deformable by application of mechanical force;
- By the simple application of mechanical force; forging

2.10.2. Cutting processes

Cutting is a collection of processes wherein material is brought to a specified geometry by removing excess material using various kinds of tooling leaving a finished part matching a set of specifications. The net result of cutting is two products, the waste or excess material, and the finished part. If this was a discussion of woodworking, the waste would be sawdust and excess wood. In cutting metals the waste is chips or swarf and excess metal. These processes can be divided into chip producing cutting, generally known as machining. Burning or cutting with an oxyfuel torch is a welding process not machining. There are also miscellaneous speciality processes such as chemical milling. Manual technologies, machine technologies, welding or burning technologies, erosion technologies are the ways whereby metals can be cut.

Cutting is fully represented in Metal Product Design by:

- Chip producing processes most commonly known as machining
- Burning, a set of processes which cut by oxidizing kerfs to separate pieces of metal
- Speciality processes

2.10.3. Joining processes

In Metal Product Design, joining process involves welding, brazing, soldering and riveting.

2.10.3.1 Welding

Langland (1999) defines welding as a process used to assemble pieces of metal together. It is also used to fill holes and build up depressed areas.

Welding is a fabrication process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the work pieces and adding a filler material to form a pool of molten material that cools to become a strong joint, but sometimes pressure is used in conjunction with heat, or by itself, to produce the weld.

2.10.3.2 Brazing

Brazing is a joining process in which a filler metal is melted and drawn into a capillary formed by the assembly of two or more work pieces. The filler metal reacts metallurgically with the work piece(s) and solidifies in the capillary, forming a strong joint. Unlike welding, the work piece is not melted. Brazing is similar to soldering, but occurs at temperatures in excess of 450°c degrees Celsius. Brazing has the advantage of producing less thermal stresses than welding, and brazed assemblies tend to be more ductile than weldments because alloying elements cannot segregate and precipitate.

Brazing techniques include, flame brazing, resistance brazing, furnace brazing, diffusion brazing, and inductive brazing.

2.10.3.3 Soldering

According to Langland (1999), Soldering is a joining process that occurs at temperatures below 449 Celsius. It is similar to brazing in the fact that filler is melted and drawn into a capillary to form a join, although at a lower temperature. Because of

this lower temperature and different alloys used as fillers, the metallurgical reaction between filler and work piece is minimal, resulting in a weaker joint.

2.11 Designing of Metalwork

Design is a conscious activity, guided by aims and objectives. It refers to planned and organized actions intended to bring about some predetermined outcome, although there may also be accidental or unexpected results. Redmond (2008) explains that design activity usually displays expertise, knowledge, creativity and thoroughness. It has a close relationship with technology, with human needs and aesthetics.

It therefore means that in designing a metal artwork, the above information must be included to make a good metal design product.

2.12 Product Design

According to Ralph (2009), Product design can be defined as the idea generation, concept development, testing and manufacturing or implementation of a product (physical object or service). Product Designers conceptualize and evaluate ideas, making them tangible through products in a more systematic approach. The role of a product designer encompasses many characteristics of the marketing manager, product manager, industrial designer and design engineer.

2.13 Industrial Design

Industrial Designers are a cross between a mechanical engineer and an artist. They study both function and form, and the connection between product and the user. They design the gears or motors that make machines move, or the circuits that control

the movement. And usually, they partner with engineers and marketers, to identify and fulfill needs, wants and expectations (Ralph, 2009).

2.14 Skills needed

According to Ralph (2009), as industrial and product designers are equipped with the skills needed to bring products from conception to market. They should have the ability to manage design projects, and subcontract areas to other sectors of the design industry. Aesthetics is considered important in Product Design but designers also deal with other important aspects including technology, ergonomics, usability, human factors and material technology.

This implies that for a good Metal Product Design work the designer must produce designs of which one is selected for the execution of the work. It therefore calls for a good and knowledgeable designer to be a Metal Product Designer.

CHAPTER THREE

METHODOLOGY

3.1 Overview

This chapter discusses the ways by which the researcher carried out his work in this thesis. It focuses on the Overview, Research Design, Library Research, Population for the study, Sampling, Data Collecting Instruments, Primary and Secondary Sources of Data, Administration of Instruments, Data Collection Procedures and Data Analysis Plan.

3.2 Research Design

The qualitative research approach was used of which descriptive research was employed to described into detailed the works produced by students of MPD Section.

Qualitative research is a field of inquiry that cuts across disciplines and subject matters. It involves an in-depth understanding of human behaviour and the reasons that govern human behaviour. Denzin and Lincoln (2003) argue that qualitative research is a situated activity that locates the observer in the world. It consists of a set of interpretive, material practices that make the world visible. These practices transform the world. They turn the world into a series of representations, including field notes, interviews, conversations, photographs, recordings, and memos to the self.

Qualitative research has two main characteristics. Leedy (2005) purported that qualitative research first and foremost it focuses on phenomenon that occurs in natural settings, that is, in the “real world”. Secondly, it involves studying those phenomena in all their complexity.

Qualitative research was used to explain the importance of the works produced by students. It also described the quality of the works produced by students of the MPD section. The processes that students go through to produce their works and how students fabricate and finish their works were all described using the qualitative method.

The researcher looked at the scope of the course. The ability of the lecturers at the MPD section was also dealt with by the researcher. A study was also conducted on works produced ten years ago and the current works that students are producing. In-depth research went into the vision of the section and whether the vision has being met. The strength and weakness were deduced from the research.

In other words, the researcher recorded, described, analyzed and interpreted findings and conditions in line with the works produced by students of the MPD section. Adequate information were gathered which made the researcher make some valuable predictions concerning the future of the MPD section.

3.3 Library Research

Libraries visited by the researcher include the KNUST Main Library, College of Art and Social Sciences libraries, Department of General Art Studies library all in KNUST, University College of Education, Winneba, Kumasi campus and Balme library, Legon. The researcher also made vital use of the internet.

In all, the researcher made use of twenty one (21) books, visited over sixty (60) internet sites. However, materials (books, etc.) and internet sites that had direct bearing to what the researcher was doing were fully utilised.

3.4 Population for the Study

Best (2002) explained that a population is any group of individuals who has one or more characteristics in common that are of interest to the researcher. The population may be all the individuals of a particular type or a more restricted part of that group.

The target population for the study was students at the MPD section and the lecturers there. The section comprises fifty three (53) second year students, forty eight (48) third year students, fifty eight (58) fourth year students and seven (7) lecturers and one (1) senior technician; a total of one hundred and sixty seven (167). The accessible population comprised: (a) one hundred and fifty nine (159) students of the section (b) seven (7) lecturers of the section, making a total of (166). The sample groups were (a) seventy eight (78) students of the section (b) six (6) lecturers of the section, making a total of (84). Fifty one (51) selected works ranging between ten years from 1999 to 2009 were also studied.

3.5 Sampling

Works of students' of MPD section were studied. Seventy eight (78) of the students and six (6) lecturers were sample for study. Fifty one (51) selected past students works ranging within a decade were also studied (1999 – 2009). Purposive sampling was used in selecting the works for study.

Seventy five percent (75%) of the total population was targeted by the researcher to administer copies of questionnaires for response, hoping that the response level would be more than thirty percent (30%). Leedy (2005), asserts that for quality research, at least, thirty percent (30%) of the total population for study, is a fair representation for an acceptable research.

3.6 Data Collection Instruments

The researcher used observation, questionnaire and interview as research tools to collect data. Participant observation was used by the researcher. The researcher interacted with students during their practical work period and participated in producing some of their work.

Two different sets of questionnaire were constructed for effectual investigation towards the collection of data. One was strictly for the lecturers at the MPD Section. This was categorized into two sections lettered A and B on a page sheet with a total of nine (9) questions. The other set of questionnaire was strictly for the students of the section. The other was a page questionnaire containing nine (9) questions. Both of which were categorized into two sections lettered A and B and were used to elicit relevant information about student's works from the population of study.

Structured interview was conducted among lecturers. Interview guides were administrated to lecturers two weeks before time. Face-to- face interviews were conducted with lecturers to retrieve information from the lecturers.

3.7 Primary and Secondary Sources of Data

Information very close to the solution of the problem of the research was treated as primary data. The primary data include information gathered from students and lecturers of the MPD section.

Data that was relevant but did not have direct bearing leading to the solution of the problem was treated as secondary data. For example most information collected from the libraries and the internet.

3.8 Administration of Instruments

The researcher administered three (3) different kinds of instruments for this research. These include observation, questionnaire and interview.

3.8.1 Observation

Best (2002) states that when observation is used in qualitative research, it usually consists of detailed notation of behaviours, events, and the contexts surrounding the events and behaviours.

The participant observation technique was used in an unstructured manner to gain access to the process used by students in producing their works. As the name suggests the researcher had to participate in most of the processes that the students were using to process their work. Processes that the researcher participated in include piercing, embossing, chasing, soldering and polishing. The researcher also used the principle of coincidence to obtain information at random at vantage points.

3.8.2 Questionnaire

Copies of questionnaire were administered personally by the researcher. In some cases, questionnaires were not answered or returned. In the first set of questionnaire administered, one hundred and nineteen (119) copies of questionnaire were distributed to respondents. Out of the one hundred and nineteen (119) copies of questionnaire distributed, only seventy eight (78) were received, representing 65.5 per cent of the respondents. This was because the majority of the respondents were working on their practical academic work at that time and most of them were behind time. With the lecturers, out of seven (7) copies of questionnaires administered to the total seven (7) respondents, six (6) were retrieved. This represents 85.7 percent of the respondents.

3.8.3 The Interview

Best (2002) stated that, the interview is in a sense an oral questionnaire. Instead of writing the response, the subject or interviewee gives the needed information orally and face-to-face (or via the telephone). The face-to-face type of interview was conducted, during which follow-up questions were asked to get more information about the section and students' works.

According to Given (2008) conversational interview is an approach used by the researchers to generate verbal data through talking about specific topics with research participant in an informal and conversational way. In some circumstances, the researcher used unstructured interview and conversations to derive relevant information vital for the study. In cases where the researcher doubted the validity of information gathered through interviews, the observation approach was adopted during students practical work time for further confirmation.

3.9 Data Collection Procedures

The researcher used participant observation in collecting information from students. The researcher participated in the practical work assigned students to retrieve some information.

The researcher went to students class to retrieve copies of questionnaire from students in person. The researcher rearranged with the class representative to collect the remaining answered copies of questionnaire. It took a period of two weeks to retrieve copies of questionnaire.

Structured interview was conducted among lecturers. Structured interview was conducted to retrieve further information immediately after the questionnaires were

returned. Interview guides were given out to lecturers two weeks. Out of seven (7) lecturers, only six (6) lecturers were interviewed. It was face-to-face interview. Structured interview was also used with the senior technician at the section.

All information organized were further compared with students' works. The lecturers were asked follow-up questions by the researcher. Photographs of works produced by students of MPD section were taken. All photographs were taken by the researcher. A total number of fifty one (51) pictures were taken. These pictures were mainly selected finished works of MPD students. Only the pictures relevant to the thesis were used since most of them fell in one category.

3.10 Data Analysis Plan

Information from students and their works were assembled. Works of graduate students ranging from a decade ago to now were also collected. They were analyzed and interpretation was given.

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Overview

This chapter is concerned with the presentation and discussion of the data collected. The data was analyzed in four parts. Analyzes which gave details about the kind of work produced by students, the strengths, weaknesses and the future direction of the works students will be producing at the section.

4.2 Responses from Questionnaire by Students of Metal Products Design

After distributing the questionnaire, the following tables show the results of data collected from students of the section. The titles of the tables were the question asked the students.

Table 4.1a: *Gender*

	Frequency	Percent
Male	51	65.4
Female	27	34.6
Total	78	100.0

Table 4.1a shows the total number of students who responded to the questionnaire. The total number of students were seventy eight (78) of which fifty one (51) were males and twenty seven (27) were females. This shows that the section is dominated by males notwithstanding there is quite a sizable number of females at the section.

Table 4.2a: Academic Year

<i>Year</i>	Frequency	Percent
2	28	35.9
3	26	33.3
4	24	30.8
Total	78	100.0

Table 4.2a above shows the breakdown of the first table. The respondents were a combination of second, third and fourth year students. Twenty eight (28) second year students. They comprised twenty four (24) males and four (4) females. This represents 35.9%. Twenty six (26) third year students who were made up of fourteen (14) males and twelve (12) females. This represents 33.3%. Fourth year had twenty four (24) students of which thirteen (13) were males and eleven (11) were females. Representing 30.8%.

Table 4.3a: Do you think jewellery is the most work produced at the metal section?

	Frequency	Percent
Yes	40	51.3
No	38	48.7
Total	78	100.0

Table 4.3a obviously shows that jewellery is the most work produced as compared to all other metal work produced at the section. In this table 51.3% of the respondents said yes whiles the remaining 48.7% said no.

Table4.4a: *What are the types of jewellery produced in the section?*

	Frequency	Percent
Body decoration	69	88.5
Social Rank	4	5.1
Cloth jewelry	5	6.4
Total	78	100.0

Table 4.4a signifies the type of jewellery produced. Whether for body, cloth and social rank decoration. The outcome of the question proved that 88.5% of the students produce jewelry for body decoration, 6.4% and 5.1% for cloth jewelry and social rank respectively.

Table 4.5a: *Are you satisfied with works produced by students of metal section?*

	Frequency	Percent
Yes	30	38.5
No	48	61.5
Total	78	100.0

In general when the respondents were asked whether they were satisfied with works produced at the section by students, 61.5 % were of the view that the works produced were not satisfactory and that they lacked certain qualities and 38.5% also believed that the works were quite okay.

Table 4.6a: *Are the metal works produced at metal section enough to meet the growing need of Ghana economy?*

	Frequency	Percent
Yes	12	15.4
No	66	84.6
Total	78	100.0

Asking about whether the works of students meet the growing need of Ghana, 84.6% said no but 15.4% said yes. This means that most of the students know their works were not meeting the expectation of their country.

Table 4.7a: *Are you satisfied with the equipment, tools and materials used at the metal section?*

	Frequency	Percent
Yes	4	5.1
No	74	94.9
Total	78	100.0

As high as 94.9% of the respondents said they are not satisfied with the equipment, tools and materials used. On the other hand 5.1% were satisfied with the equipment, tools and materials. This means that majority of students find it difficult to produce their works due to unavailability of satisfactory equipment, tools and materials.

Table 4.8a: *What do you think are the differences between the works produced by students of the metal section and works produced by the local metal designers in town?*

	Frequency	Percent
Quality design and finishing	57	73.1
Low quality design and finishing	11	14.1
The same	10	12.8
Total	78	100.0

Again here, 73.1% of the respondents believe that their works are of quality design and finishing. 14.1% respondents said their works are low quality design and finishing. Only 12.8% said they are the same.

Table 4.9a: *Is it advisable for compulsory industrial attachment for Metal Products Design students in KNUST?*

	Frequency	Percent
Yes	73	93.6
No	5	6.4
Total	78	100.0

For compulsory industrial attachment, 93.6% of the respondents wanted compulsory industrial attachment while 6.4% disagreed with that.

4.3 Responses from Questionnaire by Lecturers of Metal Product Design

Table 4.1b: Gender

	Frequency	Percent
Male	5	83.3
Female	1	16.7
Total	6	100.0

The table above shows the total number of lecturers who responded to the copies of questionnaire. Male lecturers who responded were five (5) representing 83.5% and the female was only one (1) representing 16.7%.

Table 4.2b : How best can you compare the works produced by students from 1999/2000 - 2003/2004 academic year to student works produced from 2004/2005 - 2008/2009 Academic year?

	Frequency	Percent
1999-2004 (Same standard)	5	83.3
2005-2009 (High Standard)	1	16.7
Total	6	100.0

As high as 83.3% of the respondent said works produced from 1999 – 2009 are of the same standard. 16.7% said works from 2005-2009 are of high quality than those of 1999 – 2004.

Table 4.3b: *To what percentage is jewellery produced by students in the Section?*

	Frequency	Percent
21-40	1	16.7
41-60	3	50.0
61-80	2	33.3
Total	6	100.0

Table 4.3b indicates that 50% of the respondents believe jewellery is 41-60 percent produced at the section. 33.3% believed jewellery is 61-80 percent produced and 16.7% thought jewellery is 21-40 percent produced at the section.

Table 4.4b: *Are you satisfied with the works produced by students so far?*

	Frequency	Percent
Yes	5	83.3
No	1	16.7
Total	6	100.0

Table 4.4b indicates that 83.3% of the respondents believed students' works were satisfactory while 16.7% did not think so at all.

Table 4. 5b: *What are the major work students produce in the section?*

	Frequency	Percent
Decorative Pieces	4	66.7
Other Related Metal Products	1	16.7
All	1	16.7
Total	6	100.0

Table 4.5b shows that the major works students produce at the section recorded 66.7% for decorative pieces while other related metal products and all, meaning both decorative piece and other related metal products recorded 16.7% and 16.7% respectively.

Table 4. 6b: *Can you draw a line between works produced by students in the section and the work produced by local metal producers?*

	Frequency	Percent
Yes	5	83.3
No	1	16.7
Total	6	100.0

In table 4.6b the researcher found out that 83.3% could draw a line between works of students and that of local metal industry. 16.7% could not draw a line between students and local metal designers meaning that both groups works are the same.

Table 4.7b: *Is there sufficient equipment, tool and material at the section?*

	Frequency	Percent
No	6	100.0

Table 4.7b indicates that 100% of the respondents said no, they were not satisfied with the equipment, tools and materials.

Table 4. 8b: *What strengths and weaknesses have you realised in students works?*

	Frequency	Percent
Both	6	100.0

Table 4.8b also recorded 100% of the respondents have both strengths and weaknesses comment on students' works

Table 4. 9b: *Is it advisable for Industrial attachment for Metal Product Design Students?*

	Frequency	Percent
Valid Yes	6	100.0

All the six (6) respondents agreed to the fact that it is advisable for students of the section to engage in industrial attachment.

4.4 Interview

Interviews were conducted with the lecturers of the MPD section. Five out of seven lecturers were interviewed and the only junior technician who had recently been laid off, from the Metal section.

First, respondents said the works of students are in line with the vision which is to improve the metal art industry in Ghana to meet the growing need of the country in both artistic and quantitative way to some extent. This is because the section is made up of two main branches; metalsmithing and jewellery smithing. He said students produce works in line with jewellery, lampshade, wall decorative piece, etc. He emphasized that although metalsmithing is lacking at the section in students works, the fact that they are producing jewellery makes it in line with the vision.

As to why they are admitting a lot of students at the section he said the section receives its money, based on the number of students at the section to make purchase of fuel, nitric acid just to mention a few. This money is peanut and cannot buy a equipment for use.

He also said students' works are meeting the growing need of the country. But this is to some extent. He said students of the section produce jewellery, decorated pieces and few other works. This is so because the one who led the section from the beginning specialized in jewellery and other jewellery related courses. This foundation limited the types tools, equipment and materials made available to the section. Students therefore were basically trained in jewellery.

He also laid emphasis that the section involves itself in exhibitions, though these exhibitions are held by different organizations and the section participated in it to exhibit their work. This he said is not frequent. Some years ago an exhibition was sponsored by

Alliance Française where the metal section exhibited works made up of embossed aluminum sheet for wall decoration and a few others.

He explained that there are two metal arts. These are metal art which is offered here at KNUST and metalwork which is offered at the polytechnic, KTI and some tertiary institutions. He explained that metal art is the designing aspect of metal work whereas the metalwork is without designing or without intricate design. He said if the section becomes a department he will like to take metalsmithing which constitute metal sculpture, architectural metal, etc. He then advised for the fusion of metal art and metalwork at the metal section.

There is inadequate staff and this does not auger well for a practical-oriented section like metals. This is so because currently the total number of students at the section is 153. This means that each lecturer will have about twenty two students to take care of. This would make students lack in some areas.

He finally called for a departmental status. Since the university deals with departments and not sections. This he hopes will automatically solve 50% of the problems of the metal section. He called for machinists, blacksmithing experts/blacksmiths, electroplatinists and welders as the people that should be at the workshop of the section and that all the specialists will be under the senior technician.

The second respondent agreed with all that the first respondent said with the exception of the lecturers which he said were not enough. She said the lecturers are enough, when it comes to studio or practical level the ratio is not the best. Having said that, she maintained that the logistics are the most important thing to get to make the section a standard one.

The respondent continued to say that there have been changes in the taught courses. Some of the courses have been incorporated into others to form a new one. This, she said, occurred about five to six years ago.

The third respondent on the other hand said, the vision is not necessary to work in line with the students work. This is because the programme is to train students to be skillful and have knowledge so that they can work with metals within and outside school or elsewhere. The respondent said some courses have been broadened, deepened, others have been added, like computer, ICT.

The lecturers are doing their best they could but the tools, equipment and students ability are the other necessary factors that are going against students practical works. He said it depends on how one looks at the vision for establishing the MPD Section. He pointed out that some disciplines help students to provide service only. Some disciplines also help students to provide services and product. The interviewee thinks the students are doing their best. Some students are able to produce jewellery as a product, others should be in the position to provide advice as a service.

Asked whether the MPD section had held exhibition before, the respondent said yes at Alliance Française but Accra's own did not work out. There was one under the auspices of the Science and Education in Accra recently where metal products design works were exhibited from the section.

The fourth respondent also agreed with the third respondent but believes that the works of students have met the vision of the early 1960's and 1970's. The respondent said currently, students practical works are far away from the vision and the growing need of the country. He said there has been an improvement in the courses at the section. This includes technical drawing of which he is the lecturer. He added, although students

have technical drawing knowledge, there is still more room for improvement in how students apply technical aspect in their work.

The fifth respondent agreed with all his colleagues but stressed that there should be proper structuring of things at the section and immediate departmental status be given the section.

The only junior technician who had been laid off was interviewed. He said the workshop lacks tools and equipment. He said for materials, during the early 1990's the section provided materials such as aluminum, P.V.C., stainless steel, brass rod, copper sheet and lead for the use of the section to carry out some projects which was commissioned by the chancellor, the late Otumfuo Opoku Ware, for students to use for class work.

He complained of some spoilt machines which include welding machine, grinding and polishing machines and drilling machine. He said the welding machine at the section is the electric one which is the simpler one to use as compared to the gas welding machine. Having worked at the section for 34 years he said, the tools and equipment keep on decreasing. He suggested that new tools and equipment should be bought in large quantities to match the student ratio. Broken down ones should be repaired and maintained as well as the new ones. He said lack of maintenance and stealing by some students has been the major contributor to the shortage of tools, materials and equipment.

4.5 Discussion of Results

This section discusses the results from the data collected. The discussion is grouped under the following headings: 1) Lecturers and technicians 2) Students

questionnaire and practical works 3) Analysis of students works 4) Equipment, tools and materials and other facilities 5) Shortcomings, future prospects and challenges.

4.5.1 Lecturers and technicians

Lecturers at the section have been teaching for a long time. The person with the least teaching experience at the section has five years of experience. Out of six lecturers who responded to the questionnaire, only two can continue to teach at the section for more than a decade since they are all above fifty (50) years. The taught courses at the section are all practical except history of metals.

Lecturers of the section had to teach about 40-60 students in each class. This is a heavy load on lecturers considering the fact that the vision for establishing the section needs practical supervision to achieve it. Lecturers agreed with students that jewellery is the most work produced at the section. Although lecturers are satisfied with students' works, they also need improvement of equipment, tools and materials at the section for students to improve on their work. Lecturers again, called for industrial attachment for students. They agreed with students that infrastructure must be improved.

The lecturers, technicians and students are doing their best they could but the tools, equipment and materials are the other necessary factors that are going against students' practical works. Facilities at the section, like the workshop, store room and classroom are lacking the necessary comfort for students to work effectively.

Aside facilities, lecturers also think that intake of students should be maintained to enable them supervisor students adequately.

4.5.2 Students questionnaire and practical works

The total number of students that answered the questionnaire were more than the require thirty percent for a valid population needed for a thesis.

From the questionnaire, the students indicated that although other metal works were produced, jewellery is the most work produced at the section. The students indicated in table 4.3a that 51.3% of the works produced at the section are jewellery. The researcher found out that the jewellery produced at the section could be classified into three (3) groups. The first group entails *Body decorative Jewellery* which are finger rings, ear rings, checklace, bangles and bracelet. *Social rank Jewellery* includes metal crest, chancellors rank medal, military rank medal and national awards, like the order of Volta medal make up the second group. *Cloth jewellery*, the third group had to do with tie pins, cufflins and longsleeves clippers and metal designs in cloth. Of these three, the body decorative jewellery is the most produced by students.

This means that jewellery has been the most learnt course at the section. Meanwhile seventy four point four percent of the students chose to do MPD for the reason of being well educated in metal technology and nineteen point two percent chose the programme to learn more about jewellery.

Although seventy point five agreed that they could practice what had been taught them, yet sixty one point five percent were not satisfied with what they can practice. This is a very serious issue which must be considered with immediate effect.

Again, students were satisfied with the theory courses than the practical ones. This is because about ninety four percent of students were not happy with the state of equipment, tools and materials at the section. They complained that it makes practical work tedious and difficult to achieve the best.

Students works are not meeting the growing needs of Ghana's economy due to the fact that students lack industrial exposure, equipment, tools and materials. Students, although are not happy with their works but they keep to the fact that their works are of high quality design than that of works produced by local metal designers.

Below are pictures of Metal Products Design works produced by MPD Students. The works were discussed based on source of idea, originality, composition of all the design elements in the work, processes used, craftsmanship, aesthetic qualities and remarks.



Plate 4.1: Silver chain (2008)

Source of idea/ originality and composition of work: The source of idea for the work in *plate 4:1* is from the theme unity. Originality of the work is questionable. This is because on the Ghanaian market this kind of work is already there. Composition of the metal work include elements of shape, line, texture on surface of the work and colour. The work has rhythm, balance, emphasis and some aspect of variety

Materials, tools and equipment: Silver, solder and borax form the materials of the metal work. Tools such as soldering touch, flat nose pliers, hammer, hand files, jewellery saw

blade and frame and emery paper were employed by the student. Equipment used by student include milling machine, furnace and anvil.

Process used in producing the work: Soldering, annealing, twisting and milling were the processes used by the student. The finished work was pickled and polished with emery paper, tripoli and grouche.

Craftsmanship: Irregularity in the sizes of rectangular shape in the chain makes the chain not precisely finished. Also the work appears well finished from afar but low finished when one gets closes to the work.

Aesthetic quality: The work looks aesthetically pleasing. It portrays some of the elements and principles of designing.

Remarks: The work is 100% metal. The work looks beautiful and pleasing but tiresome to the eyes. Tiresome in the sense that there is no variety of shape, element, principle of design. The eye then sees everything within a short time and gets tired of watching



Plate 4.2: Silver chain (2007)

Source of idea/ originality and composition of work: The source of idea for the work in plate 4.2 is from the theme unity. There is no newness in this work since it is commonly

done by the wayside jewelers in town. Composition of the metal work includes elements of shape, line, texture on surface of the work and colour. The work has rhythm, balance, emphasis and some aspect of variety

Materials, tools and equipment: Silver, solder and borax form the materials of the metal work. Tools such as soldering touch, round nose pliers, hammer, hand files, jewellery saw blade and frame and emery paper were used by student. Equipment used by student include milling machine and furnace.

Process used in producing the work: Soldering, annealing, twisting and milling. The finished work was pickled and polished with emery paper, Tripoli and grouche.

Craftsmanship: Irregularity in the sizes of rectangular shape in the chain makes the chain not precisely finished. Also the work appears well finished from afar but low finished when one gets closes to the work.

Aesthetic quality: The work looks aesthetically good. It depicts some of the elements and principles of designing in a well combined form.

Remarks: The work is 100% metal. The work looks beautiful and pleasing. It is not tiresome to the eye as the one in plate 4.1. This art work is more purposeful because it serves it purpose of lying on the neck flexibly.



Plate4.3: Silver chain with pendant (2008)

Source of idea/ originality and composition of work: Source of idea for the work in *plate 4.3* is from leaves, alphabet and the theme unity or togetherness. The work is new and original. The work was composed using shapes of leaves, circles, lines, texture and colour. Principle of design which includes balance, rhythm, variety, contrast and harmony are all visible in the work.

Materials, tools and equipment: Silver, solder and borax form the materials of the metal work. Tools such as soldering touch, round nose pliers, hammer, hand files, jewellery saw blade and frame, emery paper. Equipment used include milling machine and furnace.

Process used in producing the work: Piercing, soldering, annealing, twisting and milling. The finished work was pickled and polished with emery paper, Tripoli and grouche.

Craftsmanship: The work is well finished. It is precise and combine the elements and principles of design effectively.

Aesthetic quality: The work looks aesthetically good. It depicts some of the elements and principles of designing in a well combine form.

Remarks: The work is 100% metal. The pendant of the work looks clumpy and heavy. Aside that the work is original and need little improvement.



Plate 4.4: Pendant with gemstones (2006)

Source of idea/ originality and composition of work: Source of idea for the work in *plate 4.4* is deduced from the shell of a snail. The work in this plate is new because it has added to the already existing metal work. It was composed based on element of design and principles of design such as of shape, line and texture on surface of the work and colour.

Materials, tools and equipment: Silver, solder, borax and gemstone forms the materials of the metal work. Tools such as soldering touch, round nose pliers, hammer, hand files, jewellery saw blade and frame, emery paper were used. Equipment used include milling machine and furnance.

Process used in producing the work: Piercing, tube forming technique, gem setting techniques, soldering, annealing, twisting and milling were the processes that came to play in this production. The finished work was pickled and polished with emery paper, tripoli and grouche.

Craftsmanship: The work is well finished. It is precise and combines the elements and principles of design effectively. The shape of the work is finished so that it cannot hurt the user.

Aesthetic quality: Aesthetically the work looks good. Finishing techniques well executed depicts the element and principle of designing.

Remarks: The work is 100% metal. It is visible and precise. The pendant on the work looks clumsy and heavy. A different gemstone colour could have added to its beauty.



Plate 4.5: Brass crown with gemstones (2004)

Source of idea/ originality and composition of work: Source of idea for the brass crown is taken from Adinkra symbols; a combination of *Sankofa* and *ekoben*. Originality of the work is very much new in terms of design composition. It includes a good combination of lines, shapes, dots, texture and variety balance, rhythm, contrast and emphasis to bring out the beauty of the work.

Materials, tools and equipment: Brass, gemstones, borax and solder were the materials used. Tools used include jewellery saw frame and blade, soldering touch, gemsetting tools, mallet hand file, tweezers, hammer, hand files and emery paper. Equipment used include milling machine, guillotine cutting machine and furnace.

Process used in producing the work: Piercing, chasing and embossing were the main techniques used for this production.

Craftsmanship: The work is well finished in the capacity as a crown for award. It serves a purpose and it is precisely organized.

Aesthetic quality: There is beauty in the work. It is eye pleasing and nice to fit ones head.

Remarks: The work is 100% metal. It is visible and precise.



Plate 4.6: Brass crown with gemstone (2004)

Source of idea/ originality and composition of work: Source of idea for the work above is deduced from Adinkra symbols and leaves. The work in plate 4.6 is new because it has added to the already existing metal works. It was composed based on variety, emphasis, contrast, rhythm, lines, shape, texture and colour.

Materials, tools and equipment: Brass, gemstones, borax and solder were the materials used. Tools used include jewellery saw frame and blade, soldering touch, gemsetting tools, mallet hand file, tweezers, hammer, hand files and emery paper. Equipment used include milling machine, guillotine cutting machine and furnace.

Process used in producing the work: Piercing, chasing and embossing were the main techniques used for this production, tube forming technique, gem setting techniques

soldering, annealing, and milling were the processes that came to play in this production. The finished work was polished with emery paper, tripoli and grouche.

Craftsmanship: The work is well finished. It is precise and combine the elements and principles of design effectively. The shape of the work is finished to serve its purpose.

Aesthetic quality: Aesthetically, the work looks good. Finishing techniques well executed depicts, the elements and principles of designing.

Remarks: The work is 100% metal. The work is dominated with texture and dots. The down part of the art work is more concentrated. Yet it serves the purpose for which it was made.



Plate 4.7: *Light scorn shade (2006)*

Source of idea/ originality and composition of work: Idea is taken from the eagle. The originality of the work is in the technique applied to execute the work. The design composition which included a good combination of lines, shapes, dots, texture and variety, balance, rhythm, contrast and emphasis helped to bring out the beauty of the work.

Materials, tools and equipment: Copper, borax and solder were the materials used. Tools used include, carved wood, chasing tools, jewellery saw frame and blade, soldering touch, gemsetting tools, mallet, hand file, tweezers, hammer, hand files and

emery paper. Equipment used include milling machine, guillotine cutting machine and furnace.

Process used in producing the work: Chasing and embossing were the main techniques used for this production. The finished work was pickled and polished with emery paper, tripoli and grouche.

Craftsmanship: The work is well finished in the capacity as a light scorn shade. It serves a purpose and it is precisely organized.

Aesthetic quality: There is beauty in the work. It is eye pleasing and nice to decorate the home or office with.

Remarks: The work is 100% metal. It is visible and precise. A combination of brass could have been exceptional because it would have given the work a brownish and golden colour breaking colour monotony.



Plate 4.8: Mirror frame made of brass, copper and aluminum (2004)

Source of idea/ originality and composition of work: Source of idea for the mirror frame work was deduced basically from leaves. The work in this plate is not new in design-wise because it has not added to the already existing metal work. It was composed based on elements of design and principles of design.

Materials, tools and equipment: Brass, copper, aluminum, solder, borax and mirror glass were the materials used. Tools such as soldering touch, round nose pliers, mallet, chasing tools, chasing block, hammer, hand files, jewellery saw blade and frame, emery paper were used. Equipment used include milling machine and furnace.

Process used in producing the work: Piercing, chasing, embossing, soldering, annealing, and milling were the processes that came to play in this production. The finished work was polished with emery paper, tripoli and grouche.

Craftsmanship: The work is well finished. It is precise and combines the elements and principles of design effectively. The shape of the work is finished, overlapped and arranged to suit the user.

Aesthetic quality: Aesthetically, the work looks good to the sensory. Finishing techniques well executed, depicts the elements and principles of designing.

Remarks: The work is 85% metal. The work is intricate and full of variety of shapes and colour. It is serving the two purposes as a mirror and room decoration.



Plate 4.9: Aluminum and brass wall clock (2005)

Source of idea/ originality and composition of work: Source of idea is from the sun when it is scorchy. Although the motif is not new the composition of the elements of design and principles of design makes the work new and original.

Materials, tools and equipment: Brass, aluminum, solder, and borax were the materials used. Tools such as soldering touch, round nose pliers, mallet, chasing tools, chasing block, carved wood, hammer, hand files, jewellery saw blade and frame, emery paper were used. Equipment used include milling machine, guillotine and furnace.

Process used in producing the work: Piercing, chasing, embossing, soldering, annealing, and milling were the processes that came to play in this production. The finished work was polished with emery paper, tripoli and grouche.

Craftsmanship: It is precise and possesses a good combination of elements and principles of design. The shape of the work is finished, overlapped and arranged to suit the user.

Aesthetic quality: Beautiful looking and interesting to watch. Finishing and organization are very good.

Remarks: The work is 100% metal. The work is a multipurpose art work serving as a wall clock and a room decorator. The colour combination is quite good but an option of

brass – copper combination could have done better because it will not make the eyes get tired of looking at the work.



Plate 4.10: Light scorn made of brass and copper (2005)

Source of idea/ originality and composition of work: Source of idea for the light scorn is from the cocoa pod. The originality of the work lies in the composition of the elements of design and principles of design and material combination.

Materials, tools and equipment: Brass, copper, solder, and borax were the materials used. Tools such as soldering touch, round nose pliers, mallet, chasing tools, chasing block, carved wood, hammer, hand files, jewellery saw blade and frame, emery paper were used. Equipment employed include milling machine, guillotine and furnace.

Process used in producing the work: Piercing, chasing, embossing, soldering, and milling were the processes that came to play in this production. The finished work was polished with emery paper, tripoli and grouche.

Craftsmanship: It is precise and possesses a good arrangement of elements and principles of design. The shape of the work is finished, overlapped and arranged to suit the user.

Aesthetic quality: Good-looking and mirror finish. Well composed of design elements

Remarks: The work is 100% metal. It is serving its purpose. The colour combination is quite good.



Plate 4.11: Brass trophy (2005)

Source of idea/ originality and composition of work: Source of idea for the Brass trophy is from the cocoa pod and the head of a linguist's staff. The motif is new in terms of the composition of the elements of design and principles of design.

Materials, tools and equipment: Brass, solder, and borax were the materials used. Tools such as soldering touch, mallet, chasing tools, chasing block, carved wood, hammer, hand files, jewellery saw blade and frame, emery paper used. Equipment used include milling machine, guillotine, furnace and anvil.

Process used in producing the work: Piercing, chasing, embossing, soldering, annealing, and milling were the processes that came to play in this production.

Craftsmanship: It is precise and possesses a good combination of elements and principles of design.

Aesthetic quality: Beautiful looking and interesting to watch. Finishing and organization are very good.

Remarks: The work is 100% metal. The work is recommendable but the top looks too heavy than the down because it is design concentrated.



Plate 4.12: *Copper wall Hang(1999-2009)*

Source of idea/ originality and composition of work: Source of idea for the above work is from a flower and the nest of a bird on a tree. The composition of lines, shape, texture, emphasis, balance were all portrayed in the work.

Materials, tools and equipment: *Copper*, solder, and borax were the materials used. Tools such as soldering touch, mallet, chasing tools, chasing block, carved wood, hammer, hand files, jewellery saw blade and frame, emery paper were used. Equipment used include milling machine, and furnace.

Process used in producing the work: Piercing, chasing, embossing, soldering, annealing, and milling were the processes that came to play in this production.

Craftsmanship: It is precise and portable enough with good looks. Combination of elements and principles of design effectively utilized.

Aesthetic quality: Beautiful looking and interesting. Nice to appreciate.

Remarks: The work is 100% metal. The work is multipurpose art work serving as a wall vase and a room decorator. The colour work is looking at only one direction which needs improvement.



Plate 4.13: *Stainless steel hand mirror (1999-2009)*

Source of idea/ originality and composition of work: Source of idea for the work above is deduced from the adinkra symbol. Originality of the work came from the traditional setting. Composition of the elements of design and principles of design are quite visible in the work.

Materials, tools and equipment: Stainless steel, aluminum, solder, and borax were the materials used. Tools such as soldering touch, mallet, chasing tools, chasing block, hammer, hand files, jewellery saw blade and frame, emery paper were used. Equipment employed include milling machine, grinding machine, guillotine and furnace.

Process used in producing the work: Piercing, chasing, soldering, annealing, and milling were the processes that came to play in this production. The finished work was polished with grinding machine, emery paper, tripoli and grouche.

Craftsmanship: The work although well finished, its fabrication lacks precision and balancing.

Aesthetic quality: Good-looking and good finishing.

Remarks: The work is 90% metal and 10% mirror. Tiresome to watch, in the sense that there is limited number of variety of shape, elements, principles of design. The eye sees everything within a short time and gets tired of watching.



Plate 4.14: Brass table decorative piece (1999-2009)

Source of idea/ originality and composition of work: Source of idea for the work in *plate 4.14* is from umbrella. The motif although not new, the composition of the elements of design and principles of design makes the work new and original.

Materials, tools and equipment: Brass, wood, solder, and borax were the materials used. Tools such as soldering touch, mallet, carved wood, hammer, hand files, jewellery saw blade and frame, emery paper were used. Equipment used include milling machine, guillotine and furnace.

Process used in producing the work: Piercing, chasing, embossing, soldering, annealing, and milling were the processes that came to play in this production. The finished work was polished with emery paper, tripoli, grouche and vanished.

Craftsmanship: The work was simply constructed, but with good composition of design elements and principles. It is precise and possess a good combination of elements and principles of design. The shape of the work portrays the source of idea.

Aesthetic quality: Beautiful looking and interesting to watch. Finishing and organization are very good.

Remarks: The work is 95% metal and 5% wood. The colour combination is quite good but an option of brass –copper combination could have done better and a change of shape and colour of the work’s stand could have an added interest to the work.



Plate 4.15: Palm nut washing and squeezing machine (2003)

Source of idea/ originality and composition of work: Source of idea for the work above came from symbol of shapes. Although the motif is not new the composition of the elements of design and principles of design makes the work new and original.

Materials, tools and equipment: Aluminum, galvanized metal, and welding rod were the materials for the metal work. Tools such as mallet, hammer, hand files and sand paper were used. Equipment employed include welding machine, milling machine, guillotine and furnace were used.

Process used in producing the work: Welding, forging, drilling technique, annealing, and milling were the processes that came to play in this production.

Craftsmanship: The work is finished to some extent but not precise. All the same elements of design are visible in the art work for good communication.

Aesthetic quality: Finishing and organization of elements and principles of design are quite pleasing.

Remarks: The work is 100% metal. There is nothing new about the work. The work is rigid and needs much improvement.



Plate 4.16: Aluminum wall embossed piece (2008).

Source of idea/ originality and composition of work: Source of idea for the above work came from the society settings which look at the educated and the non educated person. Although the motif is not new the composition of the elements of design and principles of design makes the work original.

Materials, tools and equipment: Brass, aluminum, solder, borax, card, cloth and wood were the materials used for the metal work. Tools such as soldering touch, pliers, mallet, hammer, hand files, jewellery saw blade and frame, emery paper. Equipment employed include, guillotine and furnace were used.

Process used in producing the work: Piercing, chasing, embossing, soldering, annealing, and milling were the processes that came to play in this production.

Craftsmanship: The work is well designed and finished. It makes good of different materials to educate the public. The combination of elements and principles of design was effective.

Aesthetic quality: Beautiful looking and interesting to watch. Finishing and organization were very good.

Remarks: The work is 80% metal. The work is a multipurpose art work serving as interior decoration and educating the public. The colour combination is good.



Plate 4.17: Brass and copper Lampshade fuse with brass, paper and cloth (2006)

Source of idea/ originality and composition of work: Calabash is the source of the idea for the work in plate 4.17. Although the motif is not new, the composition of the elements of design and principles of design in the stand of the work makes it new and original.

Materials, tools and equipment: Brass, copper, solder, borax and lace cloth were the materials for the metal work. Tools such as soldering touch, round nose pliers, mallet, chasing tools, chasing block, carved wood, hammer, hand files, jewellery saw blade and

frame, emery paper were used. Equipment used include milling machine, guillotine and furnace.

Process used in producing the work: Piercing, chasing, embossing, soldering, annealing, and milling were the processes that came to play in this production.

Craftsmanship: It is precise and possesses a good combination of elements and principles of design.

Aesthetic quality: Beautiful looking and interesting to watch. Finishing and organization were very good with feminine look.

Remarks: The work is 95% metal. The work is simple and straightforward to watch.



Plate 4.18: Aluminum wall embossed piece. Fused with foam, sand and colour (2007)

Source of idea/ originality and composition of work: Source of the idea for the above work came from the society settings which look at domestic violence. The originality of the work is in the composition of the materials and the organisation of the elements and principles of design.

Materials, tools and equipment: Aluminum, card, cloth, foam, sand, glue and wood were the materials used for the metal work. Tools such as soldering touch, pliers, mallet,

hammer, hand files, jewellery saw blade and frame, emery paper were used. Equipment used include, guillotine and furnace.

Process used in producing the work: Piercing, chasing, embossing, soldering, annealing, and milling were the processes that came to play in this production.

Craftsmanship: The work is well designed and finished. It makes good use of different materials to educate the public. The combination of elements and principles of design was effective.

Aesthetic quality: Beautiful looking and interesting to watch. Finishing and organization were very good.

Remarks: The work is 80% metal. The work is a multipurpose art work serving as interior decoration and educating the public. The colour combination is good.



Plate 4.19: Ceramic cup with enamel and wooden handle (1999-2009)

Source of idea/ originality and composition of work: Source of the idea for the work in *plate 4.19* is from ordinary existing man made drinking cup and adinkra symbol handle. The only new thing about the work is the enamel technique applied. The composition of the elements of design and principles of design can be visible but not much.

Materials, tools and equipment: Ceramics, enamel were the main materials used for the metal work. Tools such as brush, tweezers, pliers and mallet as well as equipment such as enamel furnace were employed.

Process used in producing the work: Enameling was the main process used for the work. Kilning was another process used to fasten the enamel on the art work.

Craftsmanship: It is simple and the finishing needs some level of improvement.

Aesthetic quality: It contains some level of beauty.

Remarks: The work is 0% metal. There is no originality in the work.



Plate 4.20: A cup made of stainless steel ceramics and wooden handle(1999-2009)

Source of idea/ originality and composition of work: Source of the idea for the above work is from man made cup but this time around with geometric symbols on it. It is not all that original but makes good use of elements of design and principles of design.

Materials, tools and equipment: Stainless, wood and ceramics. Ceramics, enamel were the main materials used for the metal work. Tools such as brush, tweezers, pliers and mallet were used. Again, equipment used include enamel furnace and guillotine machine.

Process used in producing the work: Enameling was the main process used for the work. Kilning was another process used to fasten the enamel on the art work.

Craftsmanship: It is precise and possesses a good combination of elements and principles of design.

Aesthetic quality: Aesthetically good and interesting to watch.

Remarks: The work is 50% metal. The colour combination is quite good and the elements and principles were used effectively.



Plate 4.21: metal sculpture made up of Galvanized sheet, iron rods and tiles(2008)

Source of idea/ originality and composition of work: Source of the idea for the work in *plate 4.21* is abstract human figure forging metal piece. The work is original and possesses good composition of the elements of design and principles of design.

Materials, tools and equipment: Galvanized sheet, iron rods and tiles, cement, black paint were the materials used for the metal work. Tools such as pliers, mallet, hammer, hand files were used. Equipment used include welding machine, milling machine, and guillotine

Process used in producing the work: Forming, forging and welding were processes used by the student. The finished work was painted and mounted on constructed tile.

Craftsmanship: It is precise and possesses a good combination of elements and principles of design.

Aesthetic quality: Beautiful looking and interesting to watch. Finishing and organization were very good.

Remarks: The work is 98% metal. The work is abstract and difficult to understanding. Colour combination should be improved the next time.



Plate 4.22: Filigree metal sculpture made of iron sheet, rod and wire(2009)

Source of idea/ originality and composition of work: Source of the idea for the work in plate 4.22 is derived from butterfly and flower. The composition of the elements of design and principles of design is quite good. Although the design may be common its elements and principle of design organisation has made it original.

Materials, tools and equipment: Iron sheet, iron rod, paint and wire were the materials for the metal work. Tools such as pliers, mallet, hammer, and hand files were used.

Equipment used include welding machine, anvil, milling machine, guillotine and furnace.

Process used in producing the work: Forging, twisting and weaving techniques were applied. The finished work was painted.

Craftsmanship: It serves the purpose of its production which is coffee table. It is complicated but precise and possesses a good combination of elements and principles of design.

Aesthetic quality: Beautiful looking and interesting to observe.

Remarks: The work is 98% metal. The work is purposeful.



Plate 4.23: Coffee Table made of glass, iron rod galvanised tube(2007)

Source of idea/ originality and composition of work: Source of the idea for the work in *plate 4.23* is derived from adinkra symbols. Although the motif is not new the composition of the elements of design and principles of design makes the work new and original.

Materials, tools and equipment: Iron tubes, iron rod, tinted glass and paint were the materials used for the metal work. Tools such as pliers, mallet, hammer, and hand files

were used. Equipment used include welding machine, anvil, milling machine, guillotine and furnace.

Process used in producing the work: Forging, twisting and weaving techniques were applied. The finished work was painted.

Craftsmanship: It is simple, precise and possesses a good combination of elements and principles of design.

Aesthetic quality: Interesting to watch. Finishing and organization quite were good.

Remarks: The work is 80% metal. Needs improvement and upgradation on design composition.



Plate 4.24: Side table made of wood and iron(2002)

Source of idea/ originality and composition of work: Source of the idea for the work in plate 4.24 is derived from adinkra symbols. Although the motif is not new, the composition of the elements of design and principles of design makes the work new and original.

Materials, tools and equipment: Iron tubes, iron rod, wood and paint were the materials used for the metal work. Tools such as pliers, mallet, hammer, and hand files were used. Equipment used include welding machine, anvil, milling machine, guillotine and furnace.

Process used in producing the work: Forging, twisting and weaving techniques were applied. The finished work was then painted.

Craftsmanship: It is simple, precise and possesses a good combination of elements and principles of design.

Aesthetic quality: Fairly interesting to watch. Finishing and organization to a certain extent is good.

Remarks: The work is 80% metal. It need improvement and upgradement on design composition.



Plate 4.25: Center table and lampshade made of and galvanized tube(2009)

Source of idea/ originality and composition of work: Source of the idea for the work in *plate 4.25* originated from adinkra symbols. The motif is not new, the composition of the elements of design and principles of design makes the work new and original.

Materials, tools and equipment: Iron tubes, iron rod, cloth, wood and paint were the materials used for the metal work. Tools such as pliers, mallet, hammer, and hand files were used. Equipment used include welding machine, anvil, milling machine, guillotine and furnace.

Process used in producing the work: Forging and twisting techniques were applied. The finished works were painted.

Craftsmanship: It is simple, precise and possesses a good combination of elements and principles of design.

Aesthetic quality: The work looks aesthetically good and interesting to appreciate. Finishing and organization were quite good.

Remarks: The work is 80% metal. Looks simple and good for decoration.



Plate 4.26: Storage cabinet made of glass and stainless steel(2006)

Source of idea/ originality and composition of work: Source of the idea for the work in plate 4.26 is copied from existing ones. Not much can be said about its originality and composition of the elements of design and principles of design in terms of shape, line,

texture on surface of the work and colour because there are few elements and principles of design in the work such as balance and emphasis.

Materials, tools and equipment: Transparent glass and plastic rubber were the main materials for the metal work. Tools such as glass cutter, hack saw, hammer, hand files, and emery paper were used. Equipment used include milling machine, guillotine and furnace.

Process used in producing the work: Riveting process was used to join the frame work of the work to inset the glass.

Craftsmanship: The work is not adding. It is far from original. Technical ability is very low.

Aesthetic quality: Not all that interesting to watch. Nothing to finish.

Remarks: The work is 1% metal. The work is not much related to metal.



Plate 4.27: Jewellery box made up of copper and brass(1999-2009)

Source of idea/ originality and composition of work: The source of the idea for the work in plate 4.27 is originated from adinkra symbols. Originality of the work is based on the adinkra symbol. Composition of the metal work include elements of shape, line,

texture on surface of the work and colour. The work has rhythm, balance, emphasis and some aspect of variety

Materials, tools and equipment: Brass, copper, solder and borax form the materials of the metal work. Tools such as soldering touch, hammer, hand files, jewellery saw blade and frame, emery paper were used. Equipment used include milling machine and furnace.

Process used in producing the work: Forging, soldering, annealing and milling were used. The finished work was pickled and polished with emery paper, tripoli and grouche.

Craftsmanship: The work looks mirror finished and technically designed to serve its purpose as jewellery box.

Aesthetic quality: The work looks aesthetically pleasing. It portrays some of the elements and principles of designing such as shapes and colour.

Remarks: The work is 100% metal. The works look beautiful and pleasing but too much domination of copper metal.



Plate 4.28: Liquid kettle made of copper(1999-2009)

Source of idea/ originality and composition of work: The source of the idea for the work in *plate 4.28* originated from pawpaw fruit. Originality of the work is questionable.

This is because apart from the shape of the work, the work looks bare on the outside. Little can be talked about the composition of elements and principles design in the work.

Materials, tools and equipment: Copper, solder and borax form the materials used for the metal work. Tools such as soldering touch, pliers, hammer, hand files, jewellery saw blade and frame, emery paper were used. Equipment used include milling machine, anvil and furnace.

Process used in producing the work: Forging and beaming technique, annealing, and milling were used in the process.

Craftsmanship: The execution of the forging technique was properly used for the work to serve its purpose. Again the work appears well finished from afar but low finished when one gets closes to the work.

Aesthetic quality: The work looks aesthetically pleasing. It portrays some of the elements and principles of designing such as line, shape, colour, balance and emphasis.

Remarks: The work is 100% metal. The work looks beautiful and pleasing, but tiresome to the eyes in the sense that there is no variety of shape, elements, principles of design. The eye then sees everything within a short time and gets bored.



Plate 4.29: *Spice container with stand steel (1999-2009).*

Source of idea/ originality and composition of work: The source of the idea for the work in *plate 4.29* is foreign influence with flower design inculcated in it. Originality of the work is questionable. This is because this kind of work is on the market for sale.. Composition of design principles and elements are not well emphasized.

Materials, tools and equipment: Stainless steel, solder and borax form the materials of the metal work. Tools such as soldering touch, flat nose pliers, hammer, hand files, jewellery saw blade and frame, emery paper were used. Equipment used include milling machine, anvil and furnace.

Process used in producing the work: Soldering, annealing, etching, chasing and milling were used in the process. Finished work was polished with emery paper, tripoli and grouche.

Craftsmanship: The technical and finishing of this work leaves much to be desired.

Aesthetic quality: The work looks aesthetically pleasing but much is not seen about elements and principles of design.

Remarks: The work is 100% metal. The work looks beautiful and pleasing but simple in designing.



Plate 4. 30: Straining spoon made of stainless made of stainless steel (2004)

Source of idea/ originality and composition of work: The source of the idea for straining spoon is foreign influence. Originality of the work is questionable. This is because this kind of work is common. Composition design principle and elements are less emphasized.

Materials, tools and equipment: Stainless steel, solder and borax form the materials used. Tools such as soldering touch, hammer, hand files, jewelery saw blade and frame, emery paper were used. Equipment employed include milling machine, anvil and furnace.

Process used in producing the work: Piercing, soldering, annealing, and milling. Finished work was polished with emery paper, tripoli and grouche.

Craftsmanship: The technical and finishing of this work leaves much to be desired.

Aesthetic quality: The work looks aesthetically pleasing but much is not seen about elements and principles of design.

Remarks: The work is 100% metal. The work looks beautiful and pleasing but simple in designing.

4.5.3 Analysis of students works

Designing process according to Amenuke (1995) should be as follows:

Identifying the problem, define and specify the problem, investigate the problem (research and analysis), suggest possible solutions, model, prototype, work drawings, production (making the article) and finally appraisal. Inferring from the above students of metal section works should be identified with all the stated processes if not some.

Based on the study and in accordance with the data gathered so far, the researcher had grouped the students works at the section into four categories. These groups are:

1. ***Jewellery (Plates 4.1 to 4.6)***: These are works that students fashion mainly with precious metal like silver and to some extent brass and copper. These works are body decorated pieces which are named base on the part of the body it is going to be used. They are tiny and smaller in size and it can be easily folded or put to ones comfort place. Examples are earrings, finger ring and necklace.
2. ***Decorative work (Plates 4.7 to 4.14)***: Works in this category are the ones that students fashion mostly to decorate walls in a room and other parts of the room. These kinds of works are sizable enough. Metals like copper, brass, aluminum, stainless steel are used in fashioning these kinds of works. Examples are mirror frame, light scone, lamp shade and flower vase.
3. ***Metal technology (Plates 4.15 to 4.22)***: This group of work is the type that combined metal with other materials. It also employs scientific process that enables it to serve a lot of functions. Materials used in these kinds of works are aluminum, copper, brass, galvanize metal sheet, iron rods, wood, enamel, paper

card, cloth, foam, rubber gum, sand, oil paint, tiles. They are colossal in size and can be used almost everywhere in our environment.

4. ***Other metal work (Plates 4.23 to 4.30):*** The last group of works are those fashioned basically as utilities. They are the works that fall outside the jewelry, decorative piece and metal technology. They serve the purpose of center table, utensil, resting chairs and furniture among others. Works in this group make use of welding and soldering as the two main techniques of joining. Iron rod, stainless steel, copper, brass, transparent and tinted glass and wood are the main materials used. This group of works are the colossal than all the others.

The study of works produced by students pointed out that, students get their ideas from nature, man-made environment, symbolic forms, wise sayings and themes. A critical study of student's works show that ideas come mostly from leaves, flowers, eagle, the sun, cocoa pod, bird nest and adinkra symbols themes.

The most used techniques include embossing, chasing and piercing. These are the working techniques. The joining processes are soldering and welding. As discussed in the review of related literature, the metal common to the section which students use for their works are aluminum, brass, copper, iron rod and stainless steel. Although students works identify problem, the work is not solving the problem accurately. Some of the works lack ideas and good finishing.

4.5.4 Tools, equipment and other facilities

There are few equipment and tools at the section. This was ascertained through the research. Equipment like milling machine, guillotine cutting machine, electroplating machine, enamel machine, grinding and drilling machine and furnace burner are those

available. As a matter of fact none was in good condition although manageable but not without problems to solve. With the welding machine it got broken down not long ago before the research started.

Available tools for students use include improvised hammers, improvised tongs, improvised tweezers, anvil, bench device, hack saw, soldering touch and cylinder gas. The aesthetic qualities of student works are strictly based on material, precision, fabrication techniques and finishing techniques.

Materials such as silver, brass, copper, aluminum, stainless steel have good appearance. They finish well and have properties that make them suitable for use by students. There are high degree of *precision* in students work. Student produced works based on dimensions and specifications. These provide the work with some level of accuracy and balance. These make the work look attractive and aesthetically pleasing. Students use different kinds of techniques in *fabricating* their works. Some works are produced with a combination of two or more techniques.

The techniques employed by students make the work good looking, intriguing and interesting to appreciate. Finishing techniques employed by students include filling of the work, polishing with emery paper, polishing with grouche, blaso, tripoli and vanish or lacquer.

4.5.5 Shortcomings, future prospects and challenges.

Notwithstanding the quality of the work, the artistic aspect of the work leaves much to be desire. Although the works look quite unique, there are a lot of questions to be asked. One of the questions is, are the works metal art or metal work? Are the works expressing creativity with skill or only skill without creativity? Some of the works are

metal work which does not conform to the vision of the section which is to improve the metal art industry in Ghana to meet the growing need of the country in both artistic and quantitative way.

. Again, there are question marks about some of the works produced since the research has proven that welding is not taught and most of the works are welding works. To some extent most of the welding works lack proper finishing. Students are able to come out with designs but during the modeling process they turn to distort the finished works on the paper or model work. Consistently, almost all the works under study look good when viewed from afar, but when one gets closer to them one starts to identify problems of finishing, inadequate fabrication techniques and poor metal combination.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Overview

This chapter deals with the summary, conclusions and recommendations as a result of the findings.

5.2 Summary

The summary is based on the findings of the research. The research activity in this thesis has cleared doubts about the problems identified. Furthermore, all the objectives of the study has been investigated and established.

The main objectives of the research were in three fold:

1. To identify and describe selected types of works produced by students of MPD section.
2. To discuss the sources of ideas, processes, tools and materials and equipment used by students to produce their works.
3. To appraise selected types of works produced by students of the MPD section to ascertain their strengths and weaknesses.

The main Research Questions of the research were grouped into three:

1. How will the study identify and describe selected types of works produced by students of the MPD section?
2. To what extent will the study discuss sources of ideas, processes, tools and materials and equipment used by students in executing their works?
3. To what extent will the study bring out strengths and weaknesses of students' works at the MPD section?

The population of study comprised: (a) students of the MPD section (159) (b) lecturers of the section (7). The sample groups were (a) students of the section (b) lecturers of the section (c) selected works ranging from 1999 to 2009. The research methodology used by the researcher was qualitative research. The following research tools were employed to obtain the essential, most accurate, objective, and consistent data from the field of study – the questionnaire, interview and observation methods.

Major Findings

- It was observed through the works of students and responses to questionnaire that students at the MPD section produced different kinds of works although jewelry is the most work produced.
- Again, it was observed that jewelry or any other work related to jewelry is mainly produced as semester work while non jewelry works are often final year project work. The study also informed the researcher that in most of the works produced, students employed, at least, two metal working techniques out of the three major techniques which were indicated in the review of the related literature.
- Again the researcher found out that students produced works of good finishing as compared to those of other metal designers in town. Students' works sought to achieve aesthetic qualities, principles of design such as balance, unity, variety, contrast and harmony and elements of design.
- It was made clear through the research that students' works look pleasing to the eye from afar but lack adequate finishing when one gets close to the work.

- Based on the findings of the research, the researcher identified that students derived their ideas for designing their works from nature like human, parts of trees, animals, heavenly bodies (e.g. sun) and our traditional adinkra symbols with little modification based on the ideas from the internet.
- The section has equipment such as milling machine, guillotine cutting machine, anvil, gas soldering touch and grinding machine. Tools like improvised tongs, tweezers, improvised hammers and hacksaw are also available at the section. For materials, students acquire them by themselves. Financial strength of students determines the quality of materials bought.
- Furthermore, the research findings have classified the MPD section into four knowledge base. These include:
 1. Design of metal product,
 2. Modelling of the design,
 3. Fabricating of the model in metal
 4. Finishing of the fabricating of metalwork.
- Out of these four knowledge bases, the students are lacking in two areas: modelling of the design and the fabricating of the model in metal. These in totality affect the works of students making it fall short in relation of the vision of the MPD section.
- Another finding is that students are lacking welding technique which is another joining process used in metal work. This has limited students in their joining techniques. Most of those who insisted on this technique had to go to town.

- Aside welding technique, students are not given managerial training to know how to manage materials and Metal Products Design business after school. The findings again confirmed that the students and some of the lecturers had little knowledge about the history and the vision of the section. The researcher believes that lack of this knowledge is not a good precursor on students work and lecturers' tuition.

5.3 Conclusions

Based on the findings the researcher concludes that:

- Although Students of MPD section produce different types of works, jewellery remain largely produced work. It therefore means that the MPD section is jewellery oriented.
- Students sources of ideas are good but due to lack of tools and equipment, students cannot explore most of the basic techniques such as forming, cutting and joining processes.
- Courses of the MPD do not include industrial attachment, welding and managerial skill. Lack of these courses are posing a big challenge for students in producing their work.
- The basic metals such silver, brass, copper, and aluminum have become too dominant limiting students metal exploration.
- Students' attitude towards the programme also affects their work. Some students have little or no knowledge about the MPD. This changes the attitude of students to develop interest when they are faced with facilities problem.

- The number of lecturers compared to the number of students is one to twenty two approximately. The MPD is basically a practical programme and the number of lecturers in relation to students makes supervision not the best.
- Students' works are aesthetically good but lack modelling and fabrication techniques. These make students' works uncompetitive to the foreign products.

5.4 Recommendations

The researcher has made the following recommendations:

- Lecturers and technicians of MPD section should improve and widen the range of practical works assigned to students to produce.
- The use of nature in developing ideas must be kept and fused with themes and cultural values. Equipment and tools should be improved.
- Courses of the MPD must be upgraded to introduce industrial attachment, welding and managerial skills. Qualified persons in those fields should be considered as lecturers and technicians in those areas.
- Other forms of metals should be explored for students works.
- There should be an introduction of Metal Product Design as an elective course at all the Senior High School Level. This will give students ideas to develop more interest when they find themselves at the MPD section.
- There should be a video documentary of all the practical courses to teach students when lecturers are either in class or not to broaden the practical knowledge of students before they start practical work. This would lessen the supervision time for lecturers.

- The MPD section should be given a departmental status to enable the section stand independently to secure necessary facilities that would help the students to produce quality and competitive works.

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APPENDICES

Appendix A: QUESTIONNAIRE FOR LECTURERS

I am a M.A candidate in the Kwame Nkrumah University of Science and Technology. Currently, I am conducting a research on “A study of works produced by Metal Product Design Students of Faculty of Industrial Art”.

As part of this research, I submit the following questions for your kind and honest response. Please, any information provided will be treated confidentially as part of the general ideas and views in the final analysis of my thesis.

I thank you for your kind co-operation.

Sincerely Yours,

.....

Nicholas Addo Tetteh

(Candidate)

SECTION A

(Background information)

1. Gender: Male[] Female[]

SECTION B

(Information about metal section)

2. How best can you compare the works produce by students from 1999/2000 –

2003/2004 academic year to student works produced from 2004/2005 – 2008/2009

Academic year?.....

.....

3. To what percentage is jewelry produced by students in the Section?

1-20% [] 21- 40% [] 41-60% [] 61-80% [] 81-100%

4. Are you satisfied with the works produced by students so far? Yes [] No []

If yes please explain.....

.....

If no please explain

.....

5. What are the major work students produce in the Section?.....

.....

6. Can you draw a line between works produced by students in the section and the work produced by Local metal producer?.....

.....

.....

7. Is there sufficient equipment, tool and material at the section? Yes [] No []

If yes please explain.....

.....

If no please explain

.....

8. What strengths and weaknesses have you realised in students works?.....

.....

.....

9. Is it advisable for Industrial attachment for Metal Product Design Students?

Yes [] No [] If yes please explain.....

.....

If no please explain

.....

Thank you for your cooperation.

Appendix B: QUESTIONNAIRE FOR STUDENTS OF METAL PRODUCTS

DESIGN

This questionnaire is strictly for academic purpose hence would be confidentially treated.

This questionnaire is designed to help the researcher gather information about the strengths and weaknesses of works produced by students at the metal section.

The researcher would be very thankful if you could co-operate and answer the necessary questions asked. Please, any information provided will be treated confidentially as part of the general ideas and views in the final analysis of my thesis.

I thank you for your kind co-operation.

Sincerely Yours,

.....

Nicholas Addo Tetteh

(Candidate)

SECTION (A)

Background information

1. Gender: M (), F ().
2. Year: 1[] 2[] 3[] 4[]

SECTION (B)

Information about the Metal Section

3. Do you think jewelry is the most work produced at the metal section? Yes [], No [].

If yes how?

.....

If no why?.....

.....
4. What are the types of jewelry produced in the section?.....

.....
.....

5. Are you satisfied with works produced by students of metal section? Yes [], No []

If yes, please explain.....

.....

If no, please explain

.....

6. Are the metal works produced at metal section enough to meet the growing need of Ghana economy? Yes [], No []

If yes, how?.....

.....

If no, why?.....

.....

7. Are you satisfied with the equipment, tools and materials used at the metal section?

Yes [], No [] If yes, please explain.....

If no, please explain

.....

8. What do you think are the differences between the works produced by students of the metal section and works produced by the local metal designers in town?

.....

9. Is it advisable for compulsory industrial attachment for Metal Products Design

students in KNUST? Yes [], No []

If yes how?.....

.....

If no why?.....

.....

Thank you for your co-operation.

Appendix C: INTERVIEW GUIDE

I am a M.A candidate in the Kwame Nkrumah University of Science and Technology. Currently I am conducting a research on “A study of works produced by Metal Product Design Students of Faculty of Industrial Art”

As part of this research, I submit the following questions for your kind and candid response. Please, any information provided will be treated confidentially as part of the general ideas and views in the final analysis of my thesis.

I thank you for kind co-operation.

Sincerely Yours,

.....

Nicholas Addo Tetteh
(Candidate)

1. Are the works produced by students in line with the vision of the section?
2. Has there been change in the taught courses of the programme?
3. Can one confidently say works produced by students in the section meet the standard of the growing need of metal work in Ghana
4. Has there been any exhibition carried out by the section for the past few years?
5. How many lecturers are in the section?
6. If you were to be given the mandate to change something at the section, what would you change?

Thank you for your cooperation.