COMBINATION OF DIGITAL TECHNOLOGY WITH MANUAL METHOD OF PRINTING TO ACHIEVE PRECISION FOR HOME TEXTILES

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FEBUARY, 2017

DECLARATION

I declare that the work in this Dissertation entitled COMBINATION OF DIGITAL TECHNOLOGY WITH MANUAL METHOD OF PRINTING TO ACHIEVE PRECISION FOR HOME TEXTILES has been performed by me in the Department of Industrial Design, Ahmadu Bello University, Zaria under the supervision of Professor Gwari W. Bako and Professor S. Maiwada. The information derived from literatures has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another higher Degree or Diploma at this or any other Institution.

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Name of Student	Signature	Date

CERTIFICATION

This dissertation entitled COMBINATION OF DIGITAL TECHNOLOGY WITH MANUAL METHOD OF PRINTING TO ACHIEVE PRECISION FOR HOME TEXTILES by Oluwatosin Feyisayo FATOYINBO meets the regulations governing the award of Master of Arts in Industrial Design, of the Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This project work is dedicated to my loving parents Mr and Mrs Joshua Ilesanmi Fatoyinbo.

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To God be the glory, for he made all things beautiful at his own time. I am most grateful to the Lord God Almighty who was, is and who will forever be, for giving me the wisdom, knowledge, understanding and strength which saw me through the various obstacles and hurdles in the course of my study.

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ABSTRACT

This study is on the combination of digital technology with manual method of printing to achieve precision for home textiles. The study was conceived within the periphery of adopting the use of computer software such as CorelDraw Design Package and Photoshop Element in developing design concepts, repeat patterns and conversion of designs into lines for precise development of the designs and finally converted to some aspect of home textiles. The research problem was to address the common printing problems and challenges like over-exposure (loss of detail), misfitting of the designs, difficulty of registering screens, uneven ink deposits, and colour smear, among others. The research was aimed at achieving precision in the designing and registration of patterns for home textiles by manipulating the stencil method of printing through the combination of digital technology for easy drafting of designs and tracing of patterns after the manually generated sketches might have been scanned into the computer. This research used the experimental and studio practise research methodology and the findings were derived through the objectives and research questions of the study. The major findings of the study revealed that the use of computer software in developing design concepts and repeat patterns for home textiles gave precision and accuracy in the drafting and repeat of patterns, eased the stress of tracing with the light box, and also saved time and energy. The study concluded that with the help of computer software as one of the tools for drafting patterns of printing, the project may not only take a very short time to complete but the idea of even precision and perfection in the repeat patterns will always be assured. The study therefore recommended that Computer Aided Design should be properly harness as an aid in the studio practise, as it will reduce hardship experienced by studio textile designers of the textile studio of industrial design, Ahmadu Bello University, Zaria.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Textile printing is another part of wet technology, a wet printing process that employs the use of thickened dye or pigment print paste. It is carried out after pre-treatment of fabric or after dyeing of the fabric. Thomas (2007), described textile printing as, localized dyeing that is, dyes or pigments are applied locally or discontinuously to produce the various attractive designs on fabric. According to Helmut (2001), "the main objective of printing is the production of attractive designs with well-defined boundaries made by the artistic arrangement of a motif or motifs in one or more colours." Helmut (2001), further stated that, textile printing involves the production of a predetermined coloured pattern on a fabric, usually with a definite repeat.

In a technical approach, printing can be considered as localized dyeing. Thomas (2007), stated that, in textile printing, each different colour or print paste is opaque and placed on the fabric individually. This requires each colour to fit exactly in the print pattern which is known as design registration. Thomas (2007), further explained that, if the print is out of registration it is a serious fabric defect causing the final product to be considered off quality or second quality. It is also important that the printed colour be uniform in depth and consistent in hue. This property is known as colour clarity. The junction or boundary between colours is normally sharp and distinct. This is known as pattern definition. Pattern flushing or wicking occurs when the colours of the pattern run or wick into each other. This is considered poor definition and is a source of off quality printing.

In typical modern printing processes, the print paste is applied only from the top side of the fabric. The fabric must be thoroughly and uniformly cleaned in fabric preparation in order to ensure maximum penetration of the print paste into the textile fibres of the fabric. According to Helmut (2001), maximum penetration of the print paste is required in order to obtain the best colour fastness properties for the printed pattern. If the colour is off shade in a conventional dyeing process, it is often possible to over-dye the fabric to a darker colour, thus preserving the value of the fabric". "Unlike dyeing, printing has no remedy for reprocessing an off quality printed fabric. In order to maximize profit, a printing operation must minimize defects which result in second quality goods.

Screen printing is a process that originated and developed out of stencil printing technique. Ellis (2005), referred to screen printing as, "Serigraphy print making process that creates sharp-edge image using a stencil process, where the designs are placed upon a piece of fine mesh screen-like material and tacked to a wooden frame with various films forming material used as surface barriers". Ellis (2005), further stated that, "screen printing is equally thought to have developed from the japanesse "hair stencil" technique. When the technique was first developed, it was carried out entirely by hand."

Grice (2014), stated that, application of colouring pattern and design to decorate the finished fabric is referred as printing. At the time of printing the colour is applied to the fabric so that the colour or design is not affected at the time of washing. Textile printing is a process of applying colour to fabric in definite pattern and design. He further stated that, "textile printing is sometime confused with dyeing. In dyeing whole fabric is uniformly coloured with one color only, whereas in case of textile printing more than one colour is applied on the fabric to some part in defined pattern." Grice (2014), further stated that "in textile printing, wooden blocks, stencils, engraved

plates or rollers are used to apply colour on the fabric. Thick dyes are used at the time of printing to prevent the spreading of colour beyond the limit of design. On the bases of technology the global market for textile printing can be bifurcated into direct printing, discharge printing (white and colour discharge) and resist painting (white and colour resist). Other methods of printing include block printing, roller printing, duplex printing, screen printing, stencil printing, transfer printing, blotch printing, jet spray printing, electrostatic printing and digital printing".

Stencil method of printing are of two types, the first is the use of sticker paper and an open screen (a screen which has no image exposed - but well cleaned). It is the best method for a beginner. The Paper Stencil Method is good for geometric shapes and basic patterns. It is not intended for lettering, intricate, complicated, and floral designs intended for the purpose of this study. This study was conceived within the periphery of adopting the use of computer software in developing design concepts as well as utilizing the art of stenciling method of printing for producing home furnishing fabrics.

This research therefore explored the combination of digital technology with manual methods of printing to achieve precision in the designing and registration of patterns. According to Gwari (2008), "with the help of computer as one of the tools to draft at least a pattern for weaving, printing, dyeing, embroidery or knitting, such a project may not only take a very short time to complete but the idea of even precision and perfection (in the repeat patterns) will always be assured. It is intended therefore, that if computer is properly harnessed as an aid in the design production lines, it will reduce hardship experienced by studio textile production".

1.2 Statement of the Problem

The use of computer software for drafting, tracing and conversion of patterns into lines in textile design enhances precision. This research therefore addressed and tackled the common printing problems and challenges like over-exposure (loss of detail), misfitting of the designs, difficulty of registering screens, uneven ink deposits, colour smear, among others, by manipulating the stencil method of printing through the combination of digital technology for easy drafting of designs and tracing of patterns, conversion of designs into lines and development of designs after the manually generated sketches might have been scanned into the computer.

1.3 Aim of the Study

The aim of this study is to achieve precision in the designing and registration of patterns for home textiles using a combination of digital technology and manual method of printing.

1.4 Objectives of the Study

The objectives of this study are as follows: To

i. explore the use of computer software like CorelDraw Design Package and Photoshop Element in developing the design concepts, repeat of patterns and conversion of designs into lines.
ii. develop stencils from the computer generated and developed designs with the use of special stenciling tools such as, dual cutter, cutting knife, and circular cuter.
iii. Combine computer software and manual method of printing to achieve precision in making designs for home textiles

iv. ascertain the quality of the colour impression and the registration of designed motifs.

v. display and exhibit the end use for assessments of the design registration.

1.5 Research Questions of the Study

This study seeks to answer the following questions:

i. what are the existing computer software that can be used to achieve accurate precision in development of motifs, design concepts and the repeat patterns?

ii. how can manual method of stenciling be improved to produce accurate designs for home textiles?

iii. what are the possibilities of combining existing computer software's and manual methods to achieve accurate precision in designs for home textiles

iv. what will be the quality of colour impression and registration of designed motifs on the fabric?

v. what are the designed fabrics used for in homes ?

1.6 Justification of the Study

Achieving precision in the design and registration of patterns for home textiles has posed a lot of challenges in recent times. In this study, the use of computer software like CorelDraw design package and Photoshop Element were employed for drafting, tracing and conversion of patterns into lines in textile design to bring out the creativity and precision of the sketches gotten. Suitable designs were generated through diverse sketches before the selection of the best sketches. Natural designs were the choice of the motifs used for this study, flower and plant

motifs were picked out of numerous natural motifs available and the choice of selection was strictly based on the discretion of the researcher. These motifs are seen and concluded to be very attractive and suitable for home furnishings due to its numerous ways of creativity.

1.7 Significance of the Study

1.7.1 Educational Significance of the Study

Educationally, this study is important as it contributes to knowledge from a diverse point of view. It is an eye opener to people who are prepared and ready to work and earn a living through practical process. This study will equally serve as a reservoir of knowledge and also complement the existing literature in the area of textile stenciling printing. This study will provide a source of information for educational purpose especially today when there is limited literature that deals with comprehensive historical study on the combination of digital technology with manual methods of printing to achieve precision for home textiles. It will also serve as a resource material for future inquiry into the technique by interested researchers.

1.7.2 Aesthetics Significance

The aesthetic of this study is concerned with beauty and art, and in this study products (fabrics) are made in an artistic way and beautiful to look. Aesthetic in the creative process stimulates:

a. Aesthetic Judgment or Evaluation: This is very vital because it enables the designer to assess whether the work is satisfactory or not, so as to make necessary corrections.
b. Basis of Art Criticism: The evaluation and appreciation of fabric art by the consumers enables the product to sell itself. Beauty is in the eyes of self, as it is being said. We look

at rich colours before deciding on what to buy for fashion and for embellishing our homes and environment.

c. Economic value: Aesthetic and function determines economic value of the people who make use of them. Therefore the fabrics have to possess some good finishing for them to be acceptable and marketable.

Dutsenwai (1985) reported Dernot and Nevros (1972) as saying that colour is the first determining factor in the choice of fabrics and garments then followed by their style and make. The technical significance will cut across all levels. It will also encourage more schools and institutions to adopt this technique in their curriculum.

1.7.3 Technical Significance

In order to document and record the activities in the stencil method of printing for home furnishing fabrics utilizing computer software to develop designs and repeat patterns, a study of this nature is important. This study is very important, especially as it contributes to reduction in the cost of production, materials and time consumption. The key advantage of a stencil as related to this study is that it can be reused to repeatedly and rapidly produce the same letters or design in mass and also for as long as possible. Also, the possibility of mass production in a short period of time is rated high.

This study will also employ the use of sticker for the coating of the cardboard surfaces, front and back, as this will ensure precision in the development of the stencil and also prevent the ink from smearing on the fabric and also penetrating into the cardboard and make it wet or stained.

The technical significance will cut across all levels. It will also encourage more schools and institutions to adopt this technique in their curriculum.

1.8 Delimitation of the Study

This study is delimited to the utilization of digital and stenciling method of printing for the production of home furnishing fabrics as end products will also be produced from the printed fabrics to portray the functionality and aesthetics of the designs. The studio practice was carried out in the Textile Printing Studio of Department of Industrial Design, Ahmadu Bello University, Zaria. The following computer software were employed in this study, they are; CorelDraw Design package and Photoshop Element.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter reviewed the available related literatures that have relevance to the research being carried out. A review of past literature is a crucial endeavor for any academic research; it provides the necessary foundation or theoretical frame work upon which the researcher rests this work. The available related literatures are as follows: Historical evidence of textile printing, Historical background of stencil and its techniques, Stenciling method of printing, The relevance of Computer Aided Design (CAD) in textile design, Types of Printing: Stenciling method of printing, Flat screen and rotary screen printing, Roller printing, Heat transfer printing, Digital textile printing, Discharge and resist printing, Pigment printing.

2.2 Historical Evidence of Textile Printing

Historically, According to Ellis (2005), "simple printing techniques have existed since ancient times. The early Egyptians carved designs on the ends of walking staffs. These were dipped into strongly coloured dye solutions and then stamped onto fabrics". Ellis (2005), further recorded that, "in other early civilizations, the art form "batik" was developed. In this technique, liquid wax is applied by hand to the fabric in a pattern. Once the wax has dried the fabric is dyed. Subsequently, the wax is removed, and the fabric is dried. Next a new pattern of wax is applied and the fabric is dyed a different colour. This process can be repeated over and over to develop many unique patterns and colours, on the same fabric".

Ellis (2005), stated that, batik is the early version of the modern resist printing process. For example, in a two-colour dyeing batik where one dye is red and the other dye is blue, the fabric will exhibit unique specific properties. Ellis (2005), further stated that, where the wax pattern covered the fabric in the first dyeing but not the second, the fabric will be red. Where the wax covered the fabric in the second dyeing but not the first, the fabric will be blue. Wherever the wax was present for both dye baths, the fabric will be white. Where no wax was present for either dyeing, the fabric will be violet. However, in addition to the complex colour formation possible with this technique, the wax cracks during each dyeing process resulting in very fine random pattern lines of colour in the original fabric. This creates a unique batik fabric.

Early developments in textile printing closely followed developments in the paper printing industry. Helmut (2001), recorded that methods used by Guttenburg for his printing press in the middle ages were employed by early German textile printers. These people used designs carved into wooden plates or wood cuts to stamp various designs onto fabric. Initially this was done strictly by hand. Helmut (2001), further stated that, as time passed, printers attached both wooden and metal design plates to cylinders to somewhat mechanize the process. This led to the development of the modern engraved copper roller printing technique. This technique led to the development of silk screen printing and ultimately to the development of the modern flat bed or flat screen printing process.

The most popular industrial textile printing techniques today are the flat bed or rotary screen printing techniques. Edwin (2003), stated that, each technique typically uses screens where the pattern area is open to allow flow of the print paste through the screen while the rest of the screen is totally sealed. Print paste is only applied to the fabric in the pattern determined by the

open area of the screen. Each colour in the pattern is applied by its individual screen. Edwin (2003), further stated that, "flatbed screen printing is limited to discontinuous patterns. The repeat of the pattern can be no larger than the dimensions of the screen frame. Rotary screens are simply flat screens that have been rolled up to form a continuous seamless screen. In this process both continuous and discontinuous designs can be produced. The size of the pattern repeat is determined by the width and circumference of the screen".

Clark (1980), recorded that, "engraved roller printing uses heavy copper rollers engraved with a pattern. Each color in the pattern is applied by a separate roller. This technique was industrialized in the 1870's. It was the printing process used to produce very fine detail continuous and discontinuous designs for many years". Today, it has been almost completely replaced by rotary screen printing for a number of different technical and business reasons.

Clark (1980), further stated that, "heat transfer printing is a specialty technique that gained popularity in the 1970's. This is also known as sublimation printing or iron-on printing. In this process, paper is printed in the pattern or design required using either pigments or dyes which sublime at high temperature. The printed paper is placed against the fabric and heated to a high temperature while in contact with the fabric. After the required exposure time at the high temperature, the pattern is transferred from the paper onto the fabric. The chemical nature and temperature resistance properties limit this technique to only specific type of textile fibres. However, very detailed and complex designs can be achieved with this method".

Ellis (2005), recorded that digital printing is the process which has evolved with the development of digital design, high speed computers, and digital imaging methods. This technique uses a wide variety of textile dyes and pigments. It can also be used on most

commercially available textile fibres and fabrics. Photographic quality designs and patterns are possible. However, compared to other modern textile printing processes, this technique has very slow production speeds.

Fabric preparation is the key for obtaining consistent high quality printing results, regardless of the printing technique employed. Helmut (2001), went further to state that, commercial printing processes require ultra-clean fabrics for maximum quality results. In textile printing the print paste colour is applied from only the top side of the fabric. The fabric must be extraordinarily clean in order to promote maximum dye penetration. Any impurities left in the fabric from poor preparation can interfere with printing consistency and lead to off quality final products.

Helmut (2001), further noted that, the print paste for the wet printing processes consists of a thickened solution containing either textile dyes or pigments. Normally this paste also contains any auxiliary chemicals required by the dye or pigment formulation. Dyes must be chosen based on the fibre content of the fabric. However, just as with normal dyeing, the printed dyes are fixed inside the textile fibres. In contrast, pigments are not fibre type specific. The pigment print paste must contain a binder which glues the pigment particles to the surface of the textile fabrics. A pigment formulation depends on the adhesive qualities of the binder for the majority of its fastness properties.

The exact parameters of printing the fabric depend on the printing process used by the manufacturer. Ellis (2005), stated that, each process has specific advantages and limitations. In most cases, the printing technique chosen is selected because this is the type of equipment available to the producer. Ellis (2005), further stated that, once the fabric is printed, the fabric is dried to prevent accidental smearing or distortion of the print design. The function of the

thickener is to hold the dye or pigment in place until the color is fixed. However, the paste is still wet immediately after printing and is subject to distortion due to rubbing or abrasion until the majority of the moisture is dried out of the printed fabric. Next the dye is fixed into the textile fiber or the binder of the pigment is cured. For dyes, the fixation step requires either a steamer or a high dry heat oven.

Ellis (2005), went further to state that, the binder for most pigments is cured simply by using a high temperature dry heat oven. The exact parameters of fixation used, such as specific temperature level or dwell time, depend on the chemical nature of the dyes or pigment binders employed. Once the color has been fixed, most printed fabrics are thoroughly washed to remove all of the left-over ingredients from the print paste. Normally only the dye or the pigment-binder complex is left on the fabric after the washing process. The printed fabric is then taken to the final finishing process. In some specific cases employing pigment prints, the fabric is not washed after printing and is sold with all the print paste ingredients still on the fabric. It is highly recommended that these products be washed prior to use.

2.3 Historical Background of Stencil and its Techniques

Grice (2014), stated that, "the history of stenciling is an old one, dating back from 30,000 to 9,000 B.C it could be argued and from the time that our ancestors left the outdoors for the relative comfort of caves". Grice (2014), recorded that, "when faced with bare walls, our ancestors sought to record their lives for themselves and their children. The designs became more sophisticated as time went on, and the art of stenciling developed as well. Stenciling is still popular today, with new and old designs flourishing apace. Examples of the first stencils still survive in caves in Fiji, dating back from 30,000 to 9,000 B.C". Grice (2014), also recorded that,

“these Paleolithic stencils were created by cutting holes in banana and bamboo leaves and forcing vegetable dye through the holes. It is believed that the Baffin Islands Eskimos did something similar with dried sealskin, but none of these early examples have survived”.

Grice (2014), went further to state that, “the Egyptians used stencils to adorn tombs. The method of creating these stencils was elaborate. First, an artist would draw hieroglyphs and designs on the tomb. Then a second artist would cut into the design of the first artist with a chisel. Finally, a third artist would fill the depression with stucco, and then paint it with bright, primary colours. The Greeks and Romans used stencils as well, though, perhaps in the Romans' case, more prosaically. The Greeks made use of stencils to outline mosaic designs, according to Free Stenciling Patterns. The Romans made use of stencils to create signs, while both the Romans and Greeks used stencils to create mosaics. At first, stencils were used in Japan and China to decorate cloth, and then from A.D. 500 to 600, stencils were used to "mass produce" images of Buddha. Katazome, a form of reverse stenciling, was perfected by the Japanese and used to decorate silk”.

According to Grice (2014), “the Japanese also perfected a method of cutting multiple stencils at one time by stacking pieces of mulberry bark and carving them with a sharp knife. The Chinese developed paper stencils, due to the invention of paper in A.D. 200, and used these stencils to create embroidery patterns or to decorate material as well as porcelain. The Japanese used stenciling to create items that resembled silk screening”.

The art of stenciling traveled to the Middle East and Turkey along trade routes from Asia. Marion (2015), recorded that, “this art spread still further into Europe during the middle Ages, thanks to the Crusades, where it began to make its appearance on the walls of churches and cathedrals and in illuminated manuscripts”. Marion (2015), further stated that, “stenciling grew

popular in France during the 17th century, where it was used to decorate cards. The use of stencils to create wallpaper followed, but because the wallpaper was produced by making squares that were pieced together, the designs were not always even. When the first colonists traveled to America, they brought the art of stenciling with them. Stencils took the place of wallpaper, since the colonists were not able to afford wallpaper. They used stencils to not only decorate their walls, but floors and furniture as well. Stencils experienced a revival in the late 19th and early 20th centuries, during the Arts and Crafts Movement".

Marion (2015), went further to state, "that in the late 1700's the Japanese used complex stencil designs on silk fabric. These stencils were held within wooden frames by fine silk threads. This technique led to the development of silk screen printing and ultimately to the development of the modern flat bed or flat screen printing process. Stencils have been used to colour cloth for a very long time among other techniques used on silks for clothes during the Edo period in Japan. In Europe, from about 1450 they were very commonly used to colour old master prints printed in black and white, usually woodcuts. This was especially the case with playing-cards, which continued to be coloured by stencil long after most other subjects for prints were left in black and white".

The early forms of textile printing are stencil work, highly developed by Japanese artists, and block printing. Edwin (2003), stated that, "in the latter method a block of wood, copper or other material bearing a design in intaglio with the dye paste applied to the surface is pressed on the fabric and struck with a mallet. A separate block is used for each colour, and pitch pins at the corners guide the placing of the blocks to ensure accurate repeating of the pattern. In cylinder or roller printing, the fabric is carried on a rotating central cylinder and pressed by a series of rollers each bearing one colour. The design is engraved on the copper rollers by hand or machine

pressure or etched by pantograph or photoengraving methods; the colour paste is applied to the rollers through feed rollers rotating in a colour box, the colour being scraped off the smooth portion of the rollers with knives".

2.4 Stencil Method of Printing

The art of stencil production differs from ordinary drawing, since the design itself must be cut away, and ties must be arranged to hold the background together and to give definition to the pattern, somewhat in the manner of lines in mosaic or leaded glass. Bishop and Lord (2015), recorded that, "stencil, cutout device of oiled or shellacked tough and resistant paper, thin metal, or other material used in applying paint, dye, or ink to reproduce its design or lettering upon a surface. In a repeating border or design, registers are cut to coincide with some small detail or dot to enable the user to place the stencil accurately for each repetition. It is held securely upon the surface; while the stencil brush (with square-cut stiff bristles) is manipulated to work the medium over it (in a circular movement for fabrics) until every detail is evenly colored".

Bishop and Lord (2015), further stated that, the technique has been employed since ancient times for the decoration of walls and ceilings, pottery, furniture, textiles, leather, and small objects. It is also used in mimeographing, addressing, and lettering cases or cartons for shipping. The Chinese and Japanese employ a tough mulberry paper, making intricate stencils that are collected for their beauty. The silk-screen stencil, an innovation in silk-screen printing, is used for posters, wallpapers and textiles. In handwork, silk fabric is stretched on a frame and then coated with glue or other impervious material; a stencil paste, rubbed on with a squeegee, passes through the uncoated portions. The method has been adapted by artists to make prints known as serigraphs.

Over the years stencil design has made a transition from traditional art that is based on experience to a modern day scientific approach based on designed experiments, which will deliver optimum print performance. According to Ian and Pranchant (2013), modern technology puts high demands on the different aspects of stencil design, which has to account for the fine pitch, as well as the large pitch components on board. Moreover, to control paste print volume, an engineer has to choose the best performing aperture geometry, stencil thickness, aperture wall taper, and whether or not to electro polish; not to mention the varied manufacturing techniques, which in most cases dictate the stencil manufacturing costs.

2.5 The Relevance of Computer Aided Design in Textile Design

According to Robertson and Allen (2013), CAD is an acronym that stands for Computer Aided Design that is a project assisted by a computer. CAD is the use of computer technology to aid in the design of a product. Robertson and Allen (2013), further stated that, CAD system permits to develop project functions, mainly based on the design of the item which one wants to create by using a series of tools provided by a data processing system to improve the speed and efficiency of the operations which are usually made by hand. CAD actually encompasses all those activities of product design cycle which converts a workable concept into a ready to manufacture product specifications.

Cynthia (2000), recorded that, with electronic communication between fabric design software and production tools (weaving and knitting looms, textile printers), textile producers can achieve a more efficient industrial process and seamless communication with the consumer". Cynthia (2000), also recorded that, "CAD is used to design, develop and optimize products, which can be goods used by end consumers or intermediate goods used in other products. CAD offers

solutions dedicated to the textile market that not only decrease product time-to-market, but also improve communication efforts between design and production stages. With electronic communication between fabric design software and production tools (weaving and knitting looms, textile printers), textile producers can achieve a more efficient industrial process and seamless communication with end consumer.

Designs in the form of painted artwork or fabric samples and sometimes film negatives, with the help of CAD, are converted into workable designs by the textile designers. Cynthia (2000), also stated that, for this to be done, the works are scanned with the help of either scanners or digital cameras and then they are edited to obtain the final design CAD is broad term used to represent use of computer in designing. It can also help to draw designs for textile designers. CAD should not confuse only with drawings, it covers many aspects of designing like design calculations, data analysis and simulations. Commonly used software used for Computer Aided Design is AUTO CAD, Anseries, Photoshop Element, CorelDraw Design Package, Smart Draw etc.

The beautiful fabric designs in today's world get people wondering about how they come to be, this is the impact that computer aided design is having on the textiles and apparels industry. Cynthia (2000), went further to state that, CAD has changed the textile industry by making it easier, faster and more cost effective to produce apparels and textiles designs. Textile manufacturers use the CAD to document the textile design process and optimize manufacturing capabilities, while textile designers find it easier and more appealing to create innovative designs with technical tools. With the use of CAD textile designers are able to visualize the final product of their design without the need of producing it in physical form. Sometimes customers would want their textiles in particular design forms or patterns by providing samples in film negatives, painted artworks or fabric samples. This is something textile designers can easily deliver by

using cad to convert the ideas into workable designs. To do this, they scan the samples, feed it into the computer and then use the cad software to edit it so as to produce an appealing final result.

2.5.1 Advantages of Computer Aided Design (CAD)

Cynthia (2000), stated the advantages of Computer Aided Design as follows:

- **i.** Quick to change colours of a design
- **ii.** Textiles designs are stored electronically to ease repeat printing orders
- **iii.** Processes such as colour matching, dye weighing and fabric printing can be automated
- **iv.** Designs and information can be sent electronically on a global scale
- **v.** CAD can be used to enhance accuracy of repetitive identical production.
- **vi.** Quick to change the scale of a motif on the design
- **vii.** Quick to change design details of a design - sleeve type, collar type, length of skirt etc.
- **viii.** A design can be 'mapped' onto a figure so that you can see all round it and how the fabric would drape, how a pattern repeats.
- **ix.** Repeat patterns can be created quickly.
- **x.** Saves time of the designer as designs can be done so quickly, thus saving money, and potentially more designs created.
- **xi.** Reduces the amount of repetitive work that designers have to do.
- **xii.** Designs can be saved and used again.
- **xiii.** Designs can be sent to the buyer for instant approval.
- **xiv.** Can be linked to machinery to create a CAD/CAM machine, which designs and then makes the product. (CAD/CAM embroidery machine)

2.5.2 Disadvantages of Computer Aided Design (CAD)

Cynthia (2000), went further to state the disadvantages of Computer Aided Design as follows:

I. Specialist Computer Aided Design software is very expensive to buy often in the tens of thousands of range.
II. Designers have to be trained to use the software.

2.6 Types of Printing

Printing is carried out with different instruments. Different methods are used to produce impression on fabric. Ellis (2005), recorded that, methods of printing differ on the demand of the user. Also it depends on the fabric type and purpose of the end use of the product. The following methods can be applied for textile printing operation. They are as follows: stencil printing, flat screen printing, rotary screen printing, roller printing, heat transfer printing, and digital textile printing, discharge and resist printing and pigment printing.

2.6.1 Stencil Printing

Stencil according to Bishop and Lord (2015), **"**is a thin sheet of material, such as paper, plastic, or metal, with letters or a design cut from it, used to produce the letters or design on an underlying surface by applying pigment through the cut-out holes in the material". Bishop and Lord (2015), also stated that, "the key advantage of a stencil is that it can be reused to repeatedly and rapidly produce the same letters or design. Although stencils can be made for one-time use, typically they are made to be reusable. To be reusable, they must remain intact after a design is produced and the stencil is removed from the work surface. This is done by connecting stencil

islands (sections of material that are inside cut-out "holes" in the stencil) to other parts of the stencil with bridges (narrow sections of material that are not cut out). Screen printing also uses a stencil process. Stencils can be made with one or many color layers using different techniques, with most stencils designed to be applied as solid colors. During screen printing the images for stenciling are broken down into color layers. Multiple layers of stencils are used on the same surface to produce multi-colored images".

Stenciling has a long and rich history. Andy (2002), recorded that, "the art of stenciling has existed since the Upper Paleolithic era, approximately 40,000-10,000 years ago, with the earliest known example of "stencil" use dated to 32,000 years ago". Painted wall art reached high artistry during this period and some of the best known uses of stencils are found in cave paintings in Lascaux, France and Altamira, Spain. A common motif in cave paintings was hand tracings. Hands were placed on rock walls and the artist would spray pigment from his mouth around the outline of his hand. Primitive blowpipes made from hollowed-out reeds and bones may also have been used to dispense pigments. Early South Sea islanders also used stencils. In Fiji, banana and bamboo leaves were used as stencil material. Perforated patterns were cut into the leaves and a vegetable dye was pressed through the holes onto 'tapa', or bark cloth. Stenciled geometric borders were a favored design for clothing and textiles".

Andy (2002), further recorded that, "in Ancient Egypt stencils were used for the decoration of tombs. Artists stenciled hieroglyphs, figures and animals onto tomb walls. The resulting images were then incised around the outer edges of the design by sculptors to make a low relief, which would then be plastered and painted. Strong vibrant colors such as red oxide and yellow ochre were characteristically used in tomb decoration". In the 1960s, Andy Warhol created several

“mass produced” images from photographs of celebrities such as Marilyn Monroe, Elvis Presley and Jackie Onassis”.

The use of stencils goes back thousands of years, for both practical reasons before rubber stamps or printing presses or photocopiers were invented, stencils were used to teach children their ABCs; politicians used stencils of their signatures to get through their piles of official correspondence and to make surfaces look more beautiful and more expensive. Bishop and Lord (2015), also recorded that, “the he Europeans who colonized America were familiar with stencil designs in the houses, churches and public buildings of their homelands and brought these traditions to the New World with them. In early America, as soon as people began to have the time and money to beautify their surroundings they started to apply stencil decorations on their walls and even on their floors. In included textiles, especially bed and table coverings; furniture; and household articles such as tin and wooden trays, boxes and trunks. Early stencils were usually made of oiled heavy paper or, less commonly, leather. Later, stencils were made of tin and specially treated linen. All of these materials are still used today, although the most common modern stencil material is flexible strong plastic. Usually, a multi-color pattern required a separate stencil for each color (three colors, three stencils)”.

According to Bishop and Lord (2015), the stencil is open in the image areas, and hard and durable in the non-image areas. Consequently, ink can only be forced through the stencil in the open areas, where it then contacts the substrate. There are two basic types of stencils used in screen printing, hand-cut stencils and photo stencils. A third type of stenciling is performed typically on art prints. Called tusche-and-glue, it involves drawing the image directly onto the

screen by hand. See Tusche-and-Glue. A hand-cut stencil is the oldest form stencil-making, involving as it does the manual cutting away of the image areas to be printed.

Bishop and Lord (2015), also recorded that, "originally, thin sheets of paper were cut and attached to the bottom of the screen, and then a variety of lacquers were experimented with. In the 1930s, it was discovered that if a coat of lacquer were spread on a hard surface, it would solidify and be able to be pulled off the surface as a single piece. The formation of this lacquer film, its application to a plastic support sheet, the cutting away of the image areas of the lacquer, the adhesion of the remaining lacquer to the screen, and, finally, the removal of the backing sheet, is still the basic process of hand-cut stencils. New formulations are being developed such as water-soluble stencil emulsions which serve the same ink-blocking purpose, but are easier to adhere and remove from the screen. The lacquer- or water-based emulsion is applied to the surface of a plastic sheet. With an art knife, or other form of sharp cutting implement, the image areas are cut out of the emulsion, though it is important that the plastic support sheet itself not be marked, cut, or embossed. The original can be a photographic tracing, or an original design. It is necessary to leave at least a two-inch margin on all four sides of the stencil, so as to ensure proper adhesion to the screen fabric".

According to Grice (2014), a hand-cut stencil is applied to the screen commonly using only water. A build-up layer of glass, plastic, or other hard material, is used to raise the height of the printing bed for application of the stencil. The stencil is placed, emulsion-side up, on the top of this layer. The screen is placed, well-side up, on top of it. A layer of moisture is gently applied to the top of the screen with a sponge, and the stencil sticks to the bottom of the screen. The stencil is dried, and at that point the backing sheet can be peeled off. Alternatively, the stencil can be

applied with the screen upside-down. Lacquer-based stencils require special adhering fluid to soften the lacquer emulsion and allow it to stick to the screen fabric.

Photostencil is based on the original principle of the carbon tissue resist, in which a photosensitive emulsion is exposed to a film positive (or negative), and the resist hardens in the image or non-image areas (depending upon the nature of the resist), the soft portions being washed away. Grice (2014), also recorded that a photostencil is made by exposing the stencil to a film positive of the image. The ultraviolet light cures or hardens the emulsion in the non-image areas, leaving the unexposed image areas soft and soluble. Developing and washout procedures remove the emulsion from the image areas, opening them. The stencil is then chemically fixed, to keep the image permanent and applied to the screen fabric. Photostencils are ideal for intricate work, halftones, and other forms of images that would be difficult to accomplish with traditional, knife-cut stencils. Photostencils are prepared in one of three different ways: the indirect process, the direct process, and the combination direct/indirect process.

Grice (2014), went further to state that, after applying the stencil to the screen fabric, it is necessary to mask the portions of the screen that the stencil does not cover. This can be accomplished with craft masking paper, but this is only practical for short runs. A block out fluid which is commonly employed for this purpose is applied to both sides of the screen fabric; when dry it resists the penetration of the ink vehicle through it. It can also be used to touch up any pinholes, or other imperfections in the stencil itself. An advantage to commercially-available screen printing blockout fluids is their ability to be washed out of the screen readily at the conclusion of a print run. After printing, most water-soluble screen stencils can be removed with

water alone, but often different types of stencils require specially-formulated solvents or enzyme solutions to effectively remove the stencil.

2.6.2 Screen Printing (Flat Screen)

Banjoko (2000), stated that, more recent printing processes include screen printing, a hand method especially suitable for large patterns with soft outlines, in which screens, one for each color, are placed on the fabric and the color paste pressed through by a wooden squeegee; spray printing, in which a spray gun forces the color through a screen; and electro coating, used to apply a patterned pile. Banjoko (2000), went further to state that, "color may be applied by the various processes directly; by the discharge method, which uses chemicals to destroy a portion of a previously dyed ground; or by the resist, or reserve, method, which prevents the development of a subsequently applied color to a portion of the fabric treated with a chemical or with a mechanical resist.

Most popular industrial textile printing techniques are the flat bed or rotary screen printing techniques. Ellis (2005), also recorded that, each technique typically uses screens where the pattern area is open to allow flow of the print paste through the screen while the rest of the screen is totally sealed. Print paste is only applied to the fabric in the pattern determined by the open area of the screen. Each color in the pattern is applied by its individual screen. Flatbed screen printing is limited to discontinuous patterns. The repeat of the pattern can be no larger than the dimensions of the screen frame. Ellis (2005), explained that, rotary screens are simply flat screens that have been rolled up to form a continuous seamless screen. In this process both continuous and discontinuous designs can be produced. The size of the pattern repeat is determined by the width and circumference of the screen.

In flat screen printing, the rolls of fabric are initially fed into the printing machine in flat open-width form through the use of a scary which acts as fabric accumulator. Banjoko (2000), went further to state that, this device accumulates enough cloth to allow the printing machine to operate continuously while the machine operator sews the end of the running roll of cloth to the leading end of the new roll. Care must be taken not to load so much cloth into the scray that it tangles or binds creating distortion and shrinkage in the print fabric. Next, through the use of cloth edge guides, which maintain uniform fabric tension while minimizing fabric distortion and skew, the cloth is fed onto a continuous rubber coated, blanket.

The purpose of the blanket is to carry the fabric under the print screens during the printing process. Banjoko (2000), also recorded that, once printing has been completed, the fabric is removed and the blanket rotates under the print table where it is washed and dried. It is then rotated back to the top of the print table ready for another cycle carrying fabric under the print screens. The fabric is fixed to the blanket by applying a thin layer of glue to the backside of the fabric. This is necessary to prevent the fabric from moving or shifting once the printing process begins. If too much glue is applied, it can migrate through to the topside of the fabric and interfere with the printing process.

Birrel (1993), recorded that, the flat print screens are held in a harness. The harness raises the screens so that the rubber blanket can transport the fabric to the printing position under the screens. At this point, the rubber blanket stops. There is an individual screen for each color in the design. For example, a single color design has only one print screen. A two color design has two print screens, etcetera. The screens are lowered to the printing position by the harness. The squeegee automatically traverses from one side of each screen to the other side pushing print

paste through the open design areas. This is known as a squeegee stroke. For pile fabrics such as towels or carpet, there can be multiple squeegee strokes.

In most cases, but not all, According to Birrel (1993), the screens actually come in contact with the fabric during the squeegee stroke. When this is completed, the harness raises the screens, and the rubber blanket carries the fabric to the next printing position. Finally, the fabric stops and the printing process are repeated. In this way, this sequence is repeated over and over as the full print design is built one color at a time.

According to Clark (1980), after all design colors are printed, the fabric is carefully removed from the blanket and transported into the drying oven. Prior to drying, the printed fabric surface is wet and any mechanical contact with loose machinery parts, hanging wires or misaligned cloth guides will distort or smear the design. This destroys the quality of the print causing a permanent defect that cannot be repaired. Once dried, the printed color must be fixed or cured depending on whether dyes or pigments have been used.

Clark (1980), further stated that, It is very common for production plants to locate a curing oven or fixation oven at a separation location in the plant. When that is the case, the dried, printed fabric is held and combined with other print lots to be run through the fixation process at a later time. This is done in order to maximize the efficiency of the fixation process. After the fixation or curing process, most, but not all, printed fabrics are washed to remove the thickener and any chemical additives left on the fabric surface. The printed lot is then dried and sent to the finishing department or to the warehouse for storage and shipping.

Banjoko (2000), further stated that, “screen printing is arguably the most versatile of all printing processes. It can be used to print on a wide variety of substrates, including paper, paperboard, plastics, glass, metals, fabrics, and many other materials. Some common products from the screen printing industry include posters, labels, decals, signage, and all types of textiles and electronic circuit boards. The advantage of screen printing over other print processes is that the press can print on substrates of any shape, thickness and size”.

Banjoko (2000), went further to state that, “significant characteristic of screen printing is that a greater thickness of the ink can be applied to the substrate than is possible with other printing techniques. This allows for some very interesting effects that are not possible using other printing methods. Because of the simplicity of the application process, a wider range of inks and dyes are available for use in screen printing than for use in any other printing process. Utilization of screen printing presses has begun to increase because production rates have improved. This has been a result of the development of the automated and rotary screen printing press, improved dryers, and U.V. curable ink. The major chemicals used include screen emulsions, inks, and solvents, surfactants, caustics and oxidizers used in screen reclamation”.

2.6.3 Rotary Screen Printing

In rotary screen printing, tubular screens rotate at the same velocity as the fabric. Print paste distributed inside the tubular screen is forced into the fabric as it is pressed between the screen and printing blanket (a continuous rubber belt). According to Prasanta (2011), rotary screen printing machines are used mostly but not exclusively for bottom weight apparel fabrics or fabric not for apparel use. Host knit fabric is printed by the rotary screen method, because it does not stress (pull or stretch) the fabric during the process.

Prasanta (2011), further stated that, the typical printing speeds range from 50 to 120 yards per minute. Complex patterns require slower speeds while simple patterns, like linear stripes, can be produced at the highest speeds. This technique can also produce continuous linear patterns which cannot be printed by the flat bed screen method. However, rotary screen machines can also print discontinuous patterns. The maximum size of the pattern repeat is determined by the circumference and width of the screen. Additionally, because of the high production capability of these machines, procedures and devices have been developed to minimize the time needed for print pattern change. Practices such as print paste reuse and onmachine screen cleaning have been developed to minimize downtime between print lots. In many cases, these procedures have the further advantage of reducing the pollution load on the production waste stream.

Banjoko (2000), stated that, "the major disadvantage of rotary screen printing is the expense, or capital, required for installation of the machine and the necessary related production equipment. The machine requires a large floor space, although the rotary machine uses less floor space than the flat bed machines. With the initial development of rotary screen printing, there were print design limitations due to the construction of the screens and the type of engraving methods that were used at that time. However, many of these design limitations have been overcome by new technologies, especially laser engraving". Banjoko (2000), further stated that, "the sizes of pattern repeats are limited by the circumference of the cylindrical screen. Some machines have only the capability of using small diameter screens which would limit the size of the print pattern repeat".

2.6.4 Roller Screen Printing

According to Banjoko (2000), "engraved roller printing is a method of printing that uses heavy copper rollers engraved with a pattern. Each color in the pattern is applied by a separate roller. This technique was industrialized in the 1870's. It was the printing process used to produce very fine detail continuous and discontinuous designs for many years". Banjoko (2000), recorded that, "today, roller screen printing has been almost completely replaced by rotary screen printing for a number of different technical and business reasons. Roller printing has traditionally been preferred for long production runs because of the very high speeds possible. It is also a versatile technique since up to a dozen different colours can be printed simultaneously. The basic roller printing equipment consists of a number of copper faced rollers in which the design is etched. There is a separate printing roller for each colour being printed. Each of the rollers rotates over the fabric under pressure against an iron pressure roller". Banjoko (2000) went further to state that blanket and backing cloth rotate over the pressure roller under the fabric and provide a flexible support for the fabric being printed. A colour doctor blade removes paste or fibres adhering to the roller after contact with the fabric. After the impression stage the fabric passes to the drying and steaming stages".

2.6.5 Heat Transfer Printing

Teli and Ramani (1992), stated that, heat transfer printing is a sublimation printing or iron-on printing. In this process, paper is printed in the pattern or design required using either pigments or dyes which sublime at high temperature. The printed paper is placed against the fabric and heated to a high temperature while in contact with the fabric. After the required exposure time at the high temperature, the pattern is transferred from the paper onto the fabric. Teli and Ramani

(1992), recorded that the chemical nature and temperature resistance properties limit this technique to only specific type of textile fibers. The design on a paper is transferred to a fabric by vaporization. There are two main processes for this- Dry Heat Transfer Printing and Wet Heat Transfer Printing. In Conventional Heat Transfer Printing, an electrically heated cylinder is used that presses a fabric against a printed paper placed on a heat resistant blanket. In Infrared Heat Vacuum Transfer Printing, the transfer paper and fabric are passed between infrared heaters and a perforated cylinder which are protected from excessive heat by a shield. The Wet Heat Transfer Printing uses heat in a wet atmosphere for vaporizing the dye pattern from paper to fabric.

2.6.6 Digital Textile Printing

Helmut (2001) recorded that, digital printing is the process which has evolved with the development of digital design, high speed computers, and digital imaging methods. This technique uses a wide variety of textile dyes and pigments. It can also be used on most commercially available textile fibers and fabrics. The great advantage of this technique is the design complexity which can be achieved. Photographic quality designs and patterns are possible. However, compared to other modern textile printing processes, this technique has very slow production speeds.

Edwin (2005) also recorded that in this form of printing micro-sized droplets of dye are placed onto the fabric through an inkjet print head. The print system software interprets the data supplied by academic-Textile digital image file. The digital image file has the data to control the droplet output so that the image quality and color control may be achieved. This is the latest development in textile printing and is expanding very fast.

2.6.7 Discharge and Resist Printing

Ellis (2005), stated that in discharge and resist printing, the fabric is dyed in piece and then it is printed with a chemical that destroys the colour in the designed areas. Sometimes, the base colour is removed and another colour is printed in its place. The printed fabric is steamed and then thoroughly washed that this approach is on decline these days. In Resist printing technique, a resist paste is imprinted on the fabric and then it is dyed. The dye affects only those parts that are not covered by the resist paste. After dyeing, the resist paste is removed leaving a pattern on a dark background.

Ellis (2005) further recorded that "the discharge printing is a specialized combination of dyeing and printing. In general, printed colors do not exhibit the same high degree of color fastness that is shown by dyed products, especially when deep ground colors are required. For most discharge printing, the fabric is first dyed with the ground color required. The ground is typically a dark or deep, bright color. In some instances, this ground color may also be printed in large blotches onto the fabric instead of dyed. The dyes have to be carefully chosen so that they will be selectively destroyed or discharged by a specific chemical discharging agent. The discharging agent must only destroy the dyes and not the textile fabric. For example, vat dyes are often chosen as ground colors because they can be discharged using reducing agents, which do not damage the textile print fabric". Accoring to Ellis (2005) "the specific dyes chosen will depend on the fiber content of the print fabric and the ability of the dyes to be discharged. Selected vat and reactive dyes are often chosen for cotton or rayon while selected disperses dyes are normally chosen for polyester".

Ellis (2005) also stated that, the discharging agent is mixed into a thickened solution like typical print paste. In some instances, the discharge agent print paste can contain a dye that is unaffected by the discharge agent. The discharge paste is printed onto the fabric using either a patterned screen or and an engraved roller. The discharging agent destroys the ground color in the exact pattern where it is printed. At the same time, the dye in the discharge paste prints the fabric in the area where the original color was destroyed. This process usually results in a light pattern color surrounded by a dark background. The process can be repeated with several different pattern screens and different pattern colors. When there is no additional dye in the discharge paste, the result of the print will be white pattern areas surrounded by the dark ground color. Occasionally, a ground color will not discharge completely to a white but will discharge only to some intermediate light color. This property gives the textile printer additional styling choices.

2.6.8 Pigment Printing

According to Teli and Ramaniore (1992), Pigment printing is not only the oldest but also the easiest printing method as far as simplicity of application is concerned. more than 80% of the printed goods are based on pigment printing due to its obvious advantages, such as versatility, ease of near final print at the printing stage itself, etc. This pigment printing makes use of kerosene or mineral turpentine which is involved in making emulsion thickeners. In this system, the kerosene in the emulsion gets evaporated to the atmosphere at the time of curing of the pigment printed fabric.

Smith and Gastonia (2001), reported that the use of synthetic thickening agents and new developments in printing auxiliaries have also contributed to the increasing importance of pigment printing, since here, too, environmental aspects such as minimization of formaldehyde

emissions and carbon dioxide content must be taken into account. At the same time, novel binder systems allow a much softer handle to be attained". Smith and Gastonia (2001), reported that "formaldehyde emissions and clogging on the screens during the actual printing process must also be taken into account. These disadvantages are related to the binders used.

Smith and Gastonia (2001), further stated that, "pigment printing has gained much importance today and for some fibers (e.g. cellulose fibers) is by far the most commonly applied technique. Pigments can be used on almost all types of textile substrates and, thanks to increased performance of modern auxiliaries; it is now possible to obtain high-quality printing using this technique. Pigment printing pastes contain a thickening agent, a binder and, if necessary, other auxiliaries such as fixing agents, plasticizers, defoamers, etc. White spirit-based emulsions, used in the past as thickening systems, are used only occasionally today (mainly half-emulsion thickeners). After applying the printing paste, the fabric is dried and then the pigment is normally fixed with hot air (depending on the type of binder in the formulation, fixation can also be achieved by storage at 20°C for a few days)".

CHAPTER THREE

MATERIALS AND METHODS

3.1 Introduction

This chapter deals with the methods, procedures and materials adopted for this study. Specifically, the study dwells on such aspects as samples and sampling technique, the study area, the research method, research design, materials and methods.

3.2 Samples and Sampling Technique

The purposive sampling technique was employed in selecting the designs and materials of this study, the samples of this study were sketches, swatches, Sticker Paper, and the following computer software: Corel Draw Design Package and Photoshop Element. The choice of these materials was guided by their appropriateness and precision qualities.

3.2.1 *Sample Frame*

Natural designs were the choice of the motifs used for this study. Flower and plant motifs were picked out of numerous natural motifs available and the choice of selection is strictly based on the discretion of the researcher. Flower and plant motifs is seen and concluded to be very attractive and suitable for home furnishings due to its numerous ways of creativity. Natural colours were employed to bring out the true nature in the plant and flower motifs. The choice of colours goes alongside the naturalism of the motifs. Computer software like CorelDraw design package and Photoshop Element were employed to bring out the creativity and precision of the sketches gotten

3.2.2 *Sample Size*

Altogether, ten different types of natural motifs (floral and plant motifs) were selected to be repeated into a full paper design (as seen in plates 2a-2f). Natural colours like orange, navy blue, maroon, leaf green, lemon green, brown, pink and light purple were chosen to complement the choice of motifs. Two computer software; CorelDraw Design Package and Photoshop Element were majorly selected for the modification and development of the manually generated sketches.

3.3 The Methods used in the Study

Experimental research is result oriented and it describes what will be when certain variables are carefully controlled or manipulated. The study therefore adopted the experimental and studio practice research methodology according to Sullivan (2005) in Gundu (2014), the explorative and creative investigations that occur in studios, galleries and other places where artists work, are legitimate forms of research grounded in art practice. Maiwada (2001) stated that "the scientific evaluation of any problem must follow a sequence of steps in order to increase the chances of producing relevant data".

3.4 Research Design

A research design consists of a general outline of action or steps taken by a researcher stating how the researcher plans the study for execution. Afolabi (1993), stated that "research design is the plan, structure and strategy of investigation which produces the blue print on the steps through which the entire study was carried out to its logical end. This study therefore adopted the descriptive research design". Abdulrahman, (2011), considered descriptive research as a survey

method of discussing the data collected in a study as to how the problems of the study would be solved by relying on certain information that has been obtained.

3.5 Materials

The following materials and tools were employed for achieving successful and precise registration:

1. Corel Draw Design Package, and Adobe Photoshop Element;
2. 100% Cotton Fabric, Quality Emboss Cardboard, Sticker paper and Special Stencil Cutting Tools (Cutting Knife, Circular cutter, Circle templates), razor blade (as seen in plates 1a,1b 1c and 1d);
3. Printing Bed, Textile Ink (Seritex with binder), Succulent Form and Sizeable Brushes, Masking tape, Twine, Steel rule, Pressing Iron, Teflon sheet, Manual Hand dryer.



Plate 1a: Cutting Knife
Source – The Researcher (2015)



Plate 1b: Dual Cutter
Source – The Researcher (2015)

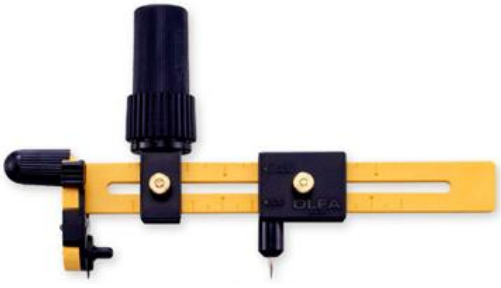


Plate 1c: Circular Cutter
Source – The Researcher (2015)



Plate 1b: Spiral Cutter
Source – The Researcher (2015)

3.6 Methods

The studio practices were based on the following steps:

3.6.1 Manual production of sketches and swatches

Ideas were derived from inspiration within the environment. The motifs were generated through sketches; diverse motifs were manually sketched with pencil and randomly selected. After the motifs are selected, swatches were designed in different colour ways using poster colour and sizeable brushes (as seen in plates 2a, b, c, d, e, f, g, h, and i below). Coloured swatches in respect of the ideas generated were repeated on a full paper design according to the sizes chosen by the researcher (as in plates 2j, k, l, m, n, o, p, q, r, s, t, u, v, w, and x below). Once the repeat patterns has been achieved, the first stage is the application of colour on the repeated pattern after it might have been printed out on a cardboard paper in order to preview the repeat patterns and the colour distribution before the design is transferred onto the fabric. At this stage, the designs are viewed on the paper design as it will be on the fabric; most importantly, corrections can still be made at this stage before transferring the designs to the fabric.

The selected designs were screened from other achieved designs due to the consideration of home textiles designs which has its uniqueness from other textiles designs like dress designs and outdoor designs. Also, the designs were selected based on the fact that the production was limited to stenciling method of printing which requires legible designs.



Plate 2a: Generating sketches

Source – The researcher (2015)



Plate 2b: pencil Sketches

Source – The researcher (2015)

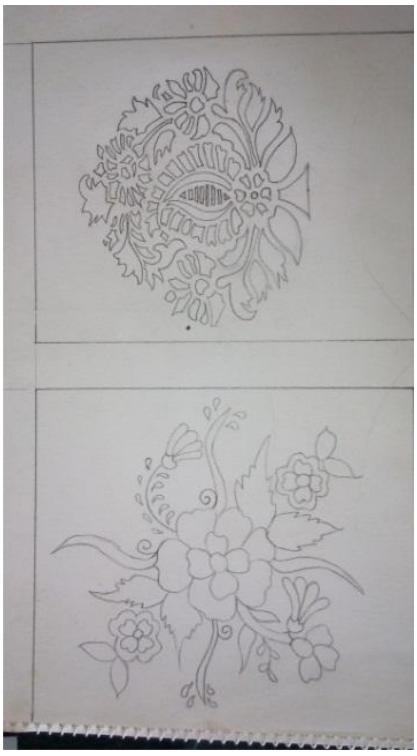


Plate 2c: pencil Sketches

Source – The researcher (2015)



Plate 2d: Pencil Sketches

Source – The researcher (2015)



Plate 2e: Swatches Produced

Source – The researcher (2015)



Plate 2f: Swatches Produced

Source – The researcher (2015)



Plate 2g: Coloured Swatches

Source – The researcher (2015)



Plate 2h: Coloured Swatches

Source – The researcher (2015)



Plate 2i: Coloured Swatches

Source – The researcher (2015)



Plate 2j: 1st and 2nd Colour

Source – The researcher (2015)



Plate 2k: 3rd and 4th Colour

Source – The researcher (2015)



Plate 2l: Full Design

Source – The researcher (2015)



Plate 2m: 1st and 2nd Colour

Source – The researcher (2015)



Plate 2n: 3rd and 4th Colour

Source – The researcher (2015)



Plate 2o: Full Design

Source – The researcher (2015)



Plate 2p: 1st and 2nd Colour

Source – The researcher (2015)



Plate 2q: 3rd and 4th Colour

Source – The researcher (2015)



Plate 2r: Full Design

Source – The researcher (2015)



Plate 2s: 1st Colour

Source – The researcher (2015)



Plate 2t: 2nd and 3rd Colour

Source – The researcher (2015)



Plate 2u: Full Design

Source – The researcher (2015)



Plate 2v: 1st, 2nd, 3rd, and 4th Colour.

Source - The researcher (2015)



Plate 2w: 5th colour

Source – The researcher (2015)



Plate 2x: Full Design

Source – The researcher (2015)

3.6.2 Production of Computer Aided Sketches and Swatches

Some sketches were as well generated from computer using the CorelDraw Design package and Photoshop Element (as in plates 3a and 3b below). CorelDraw Design package and Photoshop Element were also employed for colour application on the designs after the designs was scanned into the computer to be converted into lines for easy application of the colours on the computer.. This was done to view the differences between manual colour application and computer colour application, there was precision in the computer colour application compared to the manual colour application (as seen in plates 3c, d, e, f, g, and h below).

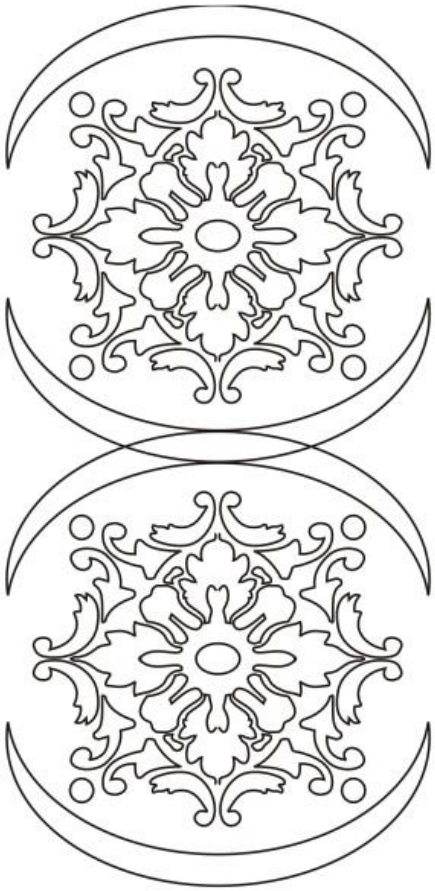


Plate 3a: Computer Generated sketches

Source – The researcher (2015)



Plate 3b: Computer Generated sketches

Source – The researcher (2015)



Plate 3c: Computer Colour Application

Source – The researcher (2016)

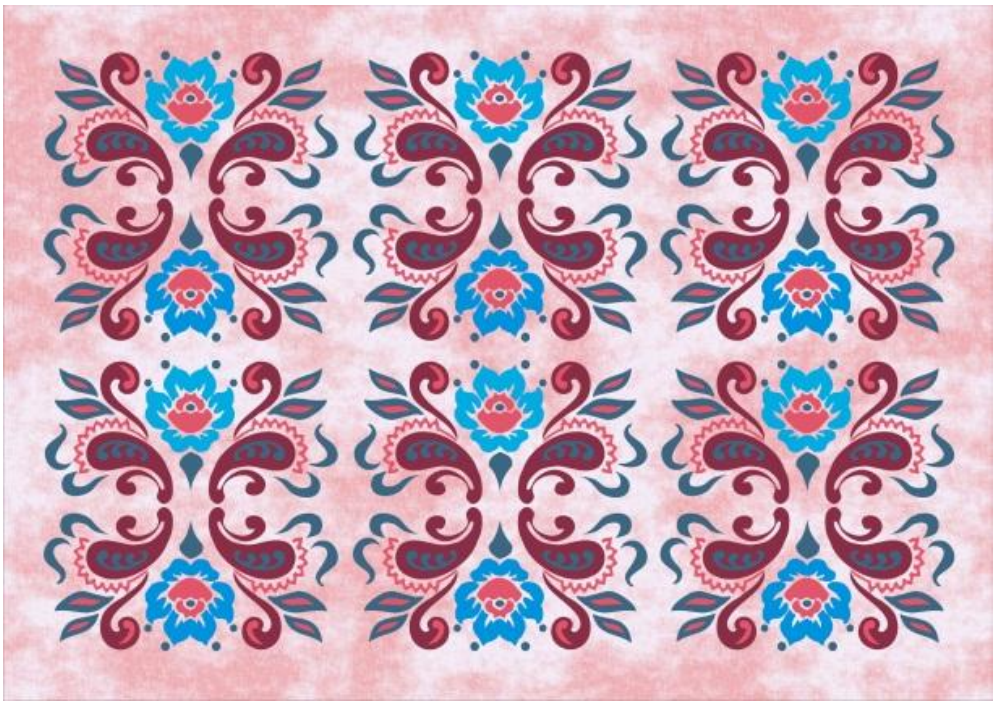


Plate 3d: Computer Colour Application

Source – The researcher (2016)



Plate 3e: Computer Colour Application

Source – The researcher (2016)



Plate 3f: Computer Colour Application

Source – The researcher (2016)

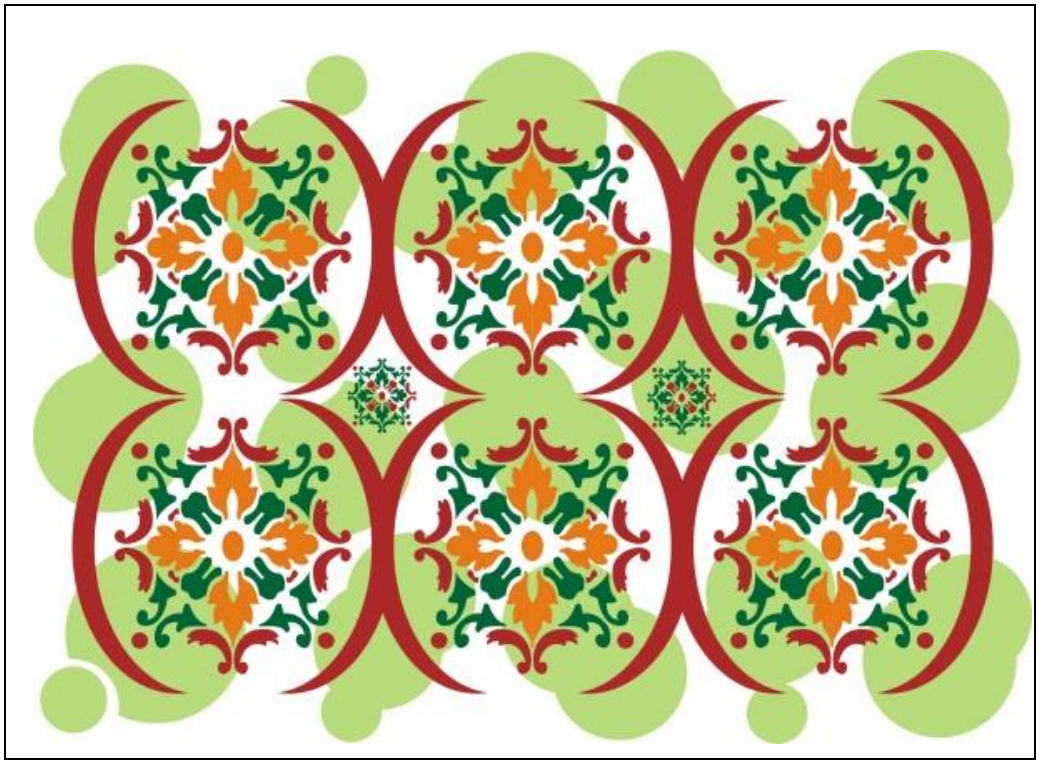


Plate 3g: Computer Colour Application

Source – The researcher (2016)

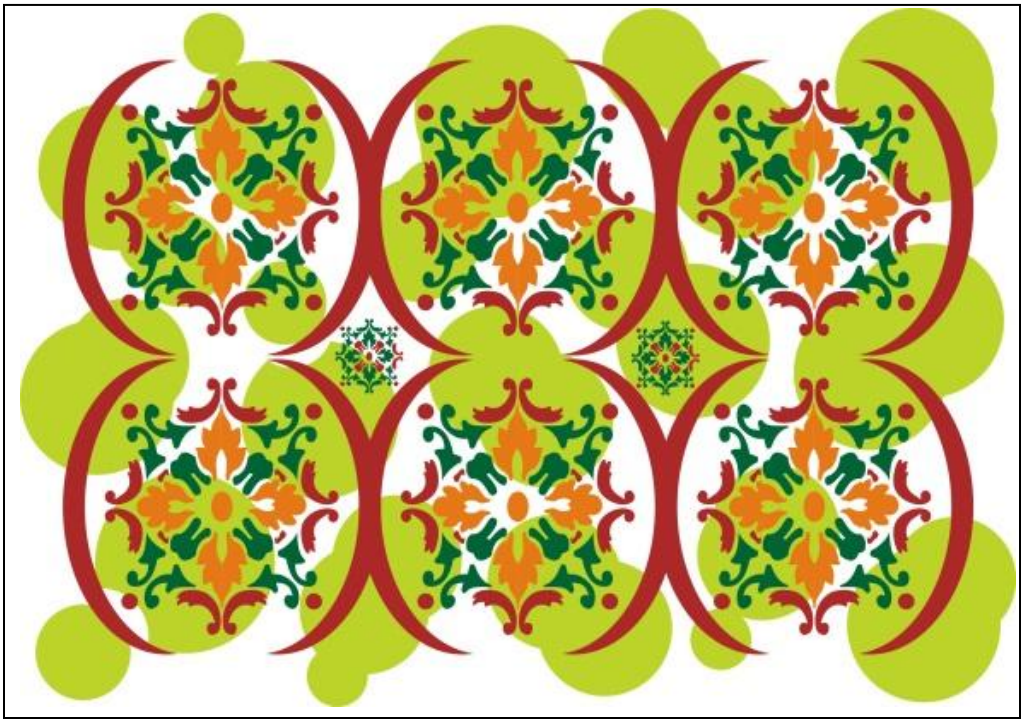
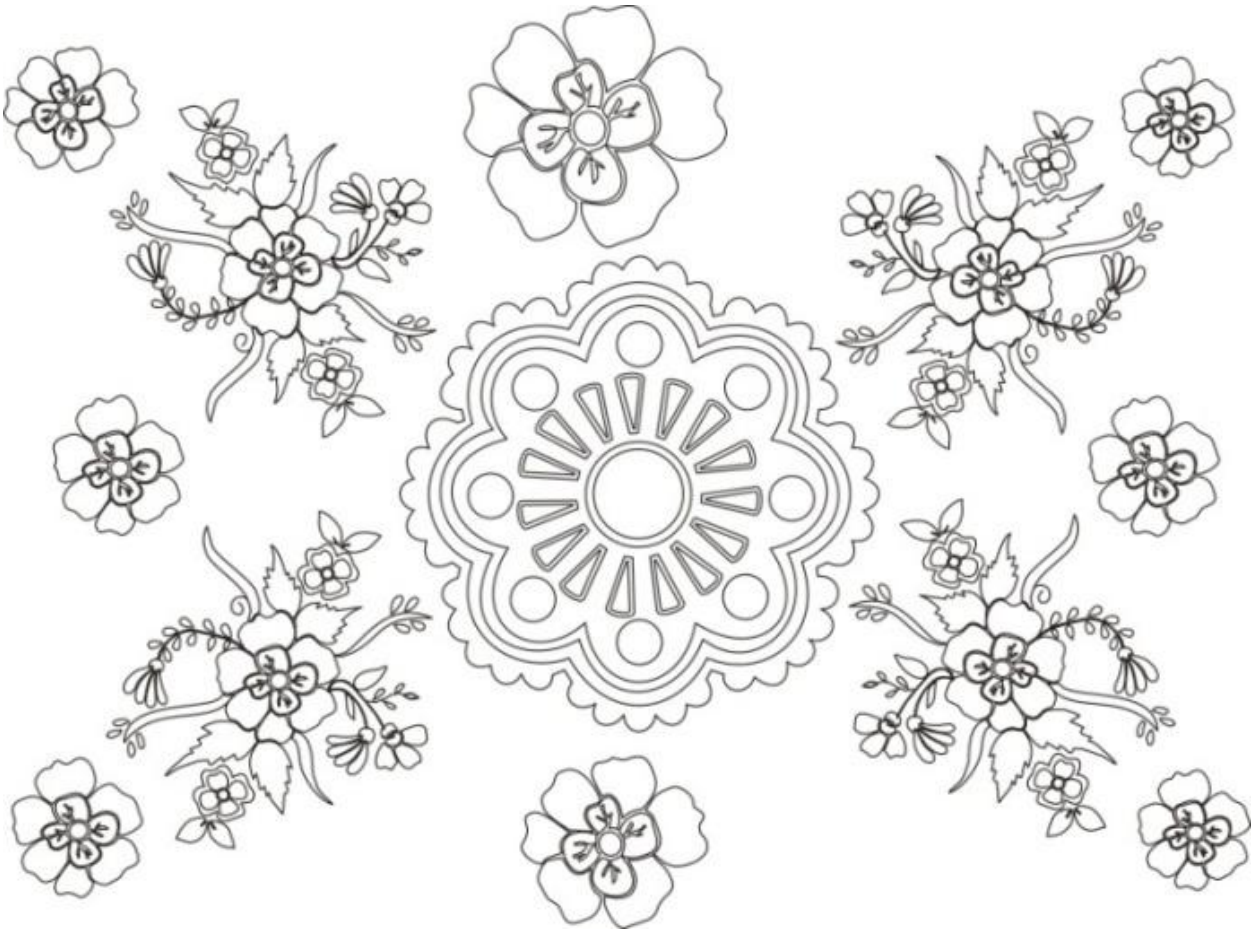


Plate 3h: Computer Colour Application

Source – The researcher (2016)

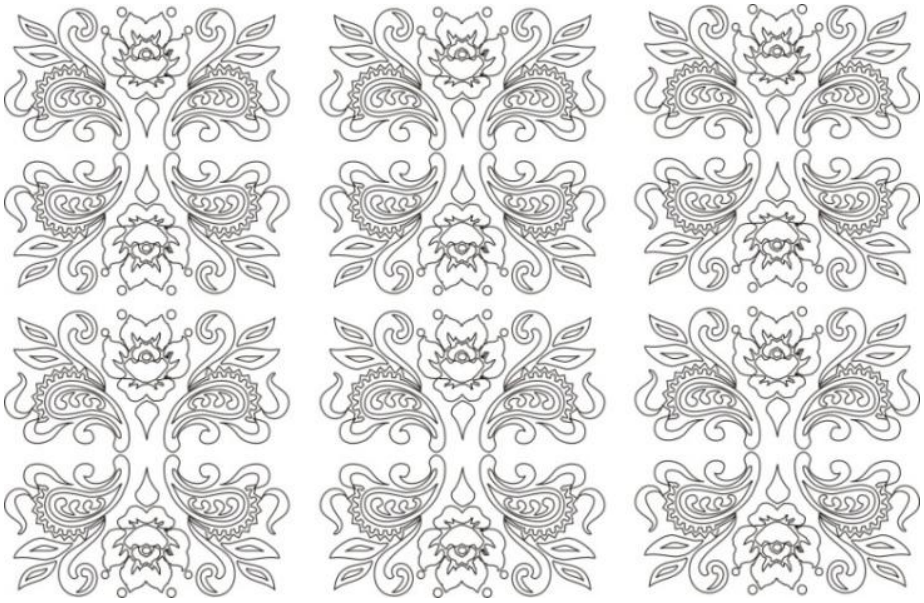
3.6.3 Combined Procedure to Achieve Accurate Precision of Home Textiles Design

After the motifs are scanned and transferred to the computer for modification, CorelDraw Design Package and Photoshop Elements were employed for the development of the designs and the repeat patterns as it's easy to move components of the design around, especially if the design involves text after which they were converted to lines for perfect and precise cut (as seen in plates 4a, b, c, d, e, and f below).



Plates 4a: Computer Aided Designs

Source – The researcher (2015)



Plates 4b: Computer Aided Designs

Source – The researcher (2015)

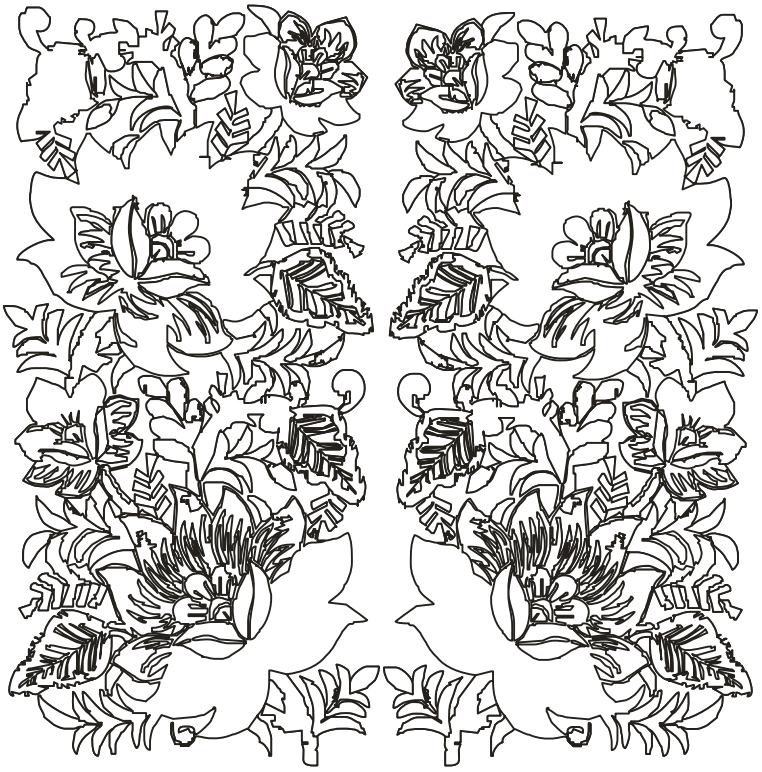


Plate 4c: Computer Aided Designs

ource – The researcher (2015)

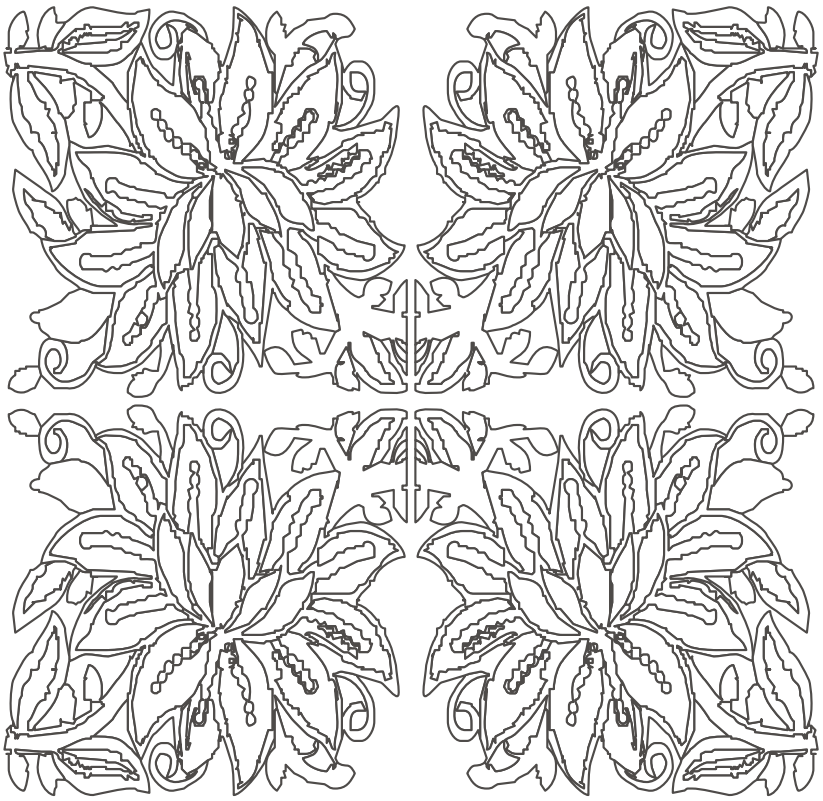
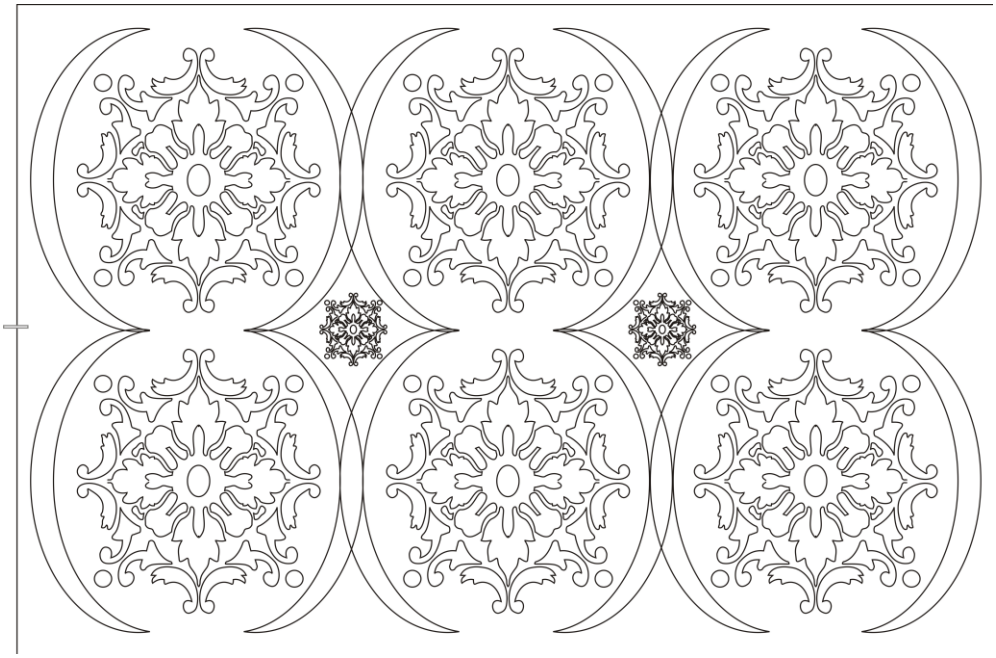


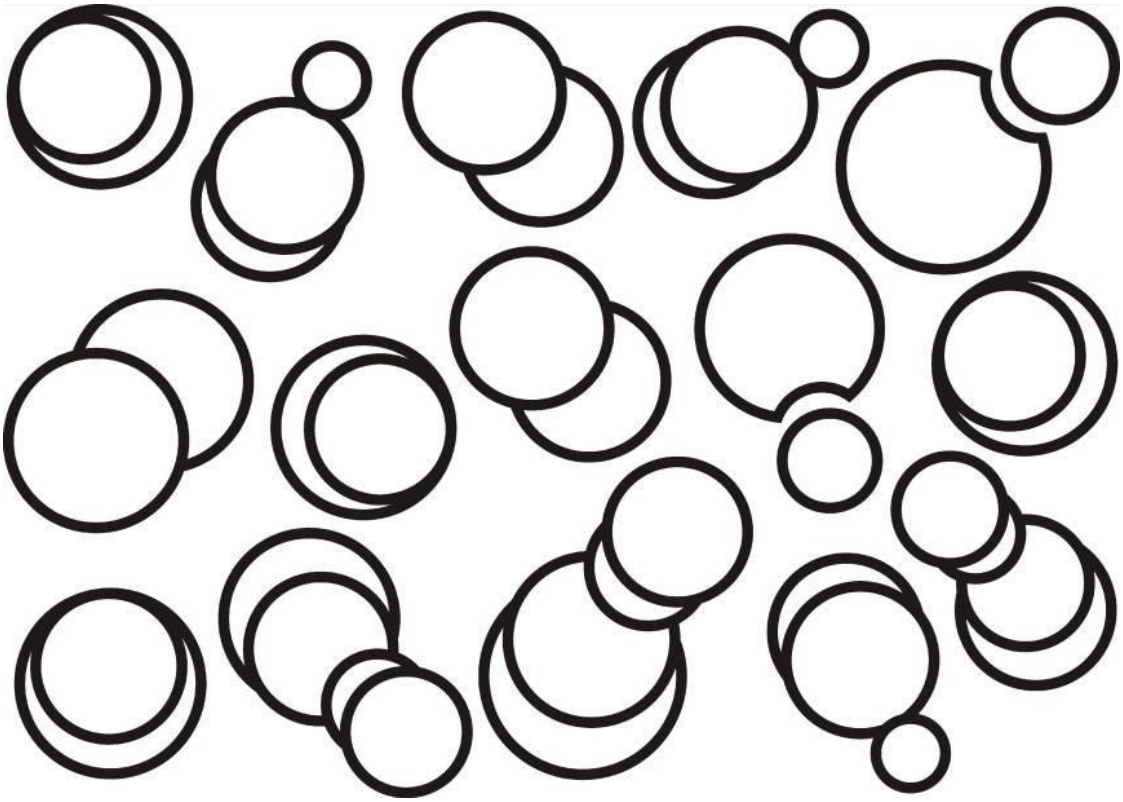
Plate 4d: Computer Aided Designs

Source – The researcher (2015)



Plates 4e: Computer Aided Designs

Source – The researcher (2015)



Plates 4f: Computer Aided Designs

Source – The researcher (2015)

3.6.4 Development of Stencils from the Computer Generated Designs

Once the design was achieved on the computer, it was printed out in black and white. The design was printed on Emboss cardboard paper, preferably white so as to enable clarity. The cardboard was sealed with paper sticker front and back in order to achieve precision and accuracy while developing the stencils and also for proper registration of ink on the fabric.

The development of the stencil was done using the stencil special cutting tools: Cutting knife, circular cutter, circular templates and razor blade. With the previous steps correctly followed, the black areas of the design were removed. The black areas were kept in one piece; as they will be

needed later. If there is a white area that is "floating," that is completely surrounded by black, it shall be kept too. The white stencil left over after cutting the black` part out is called the "positive stencil" and the black that was cut out is the "negative stencil." Each stencil represents a plate (each colour) as seen in plates 5a, b, c, d, e, f, g, h, I, and j below.

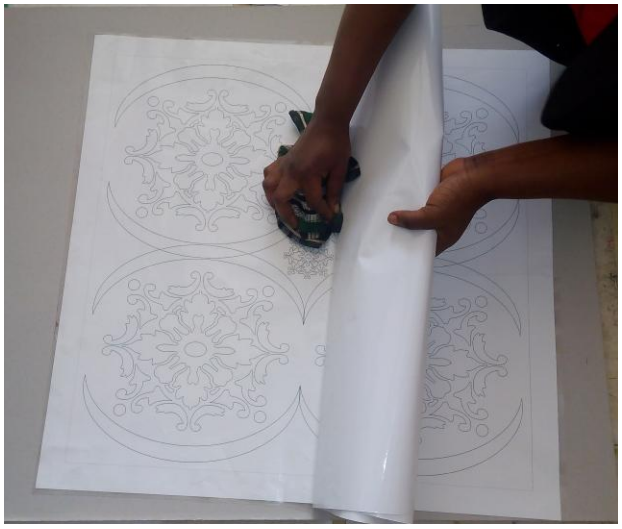


Plate 5a: Sticker Application

Source – The researcher (2016)

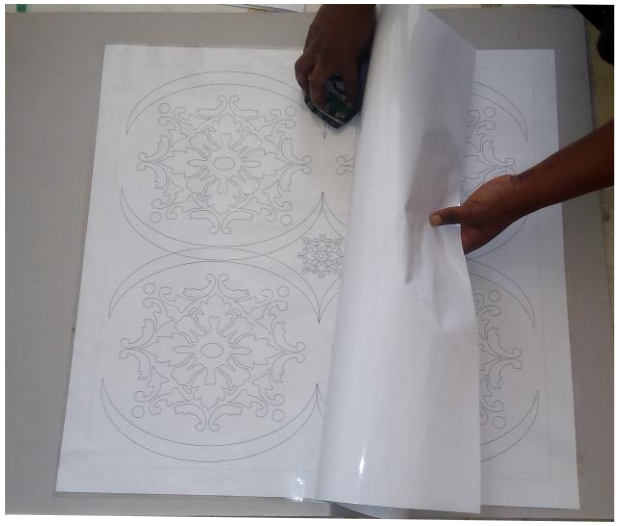


Plate 5b: Sticker Application

Source – The researcher (2016)



Plate 5c: Developing Stencil

Source – The researcher (2016)



Plates 5d: Developed Stencils

Source – The researcher (2016)



Plates 5e: Developed Stencils

Source – The researcher (2016)



Plates 5f: Developed Stencils

Source – The researcher (2016)



Plates 5g: Developed Stencils

Source – The researcher (2016)



Plates 5h: Developed Stencils

Source – The researcher (2016)



Plates 5i: Developed Stencils

Source – The researcher (2016)



Plates 5j: Developed Stencils

Source – The researcher (2016)

3.6.5 Mixture of Textile Inks

Textile inks of different colours according to the design produced was mixed and stirred well for uniform texture and to avoid particles. This was done and kept for few weeks before the application of the inks on the fabric for the fermentation of the inks so as to enable smoothness while applying on the fabric and also to avoid particles of the ink on the fabric. Different colours were mixed according to the achieved colours on the paper work (painting). Textile ink (seritex) with binder was the choice of pigment used due to its appropriateness for the work as seen in Plates 5a and 5b below.



Plate 6a: Mixture of Textile Inks

Source – The researcher (2016)

3.6.6 Preparation of the Fabric and Printing

Pretreatment of the fabric was done to get rid of the impurities such as oils, starch and so on. It will also enable the fabric to absorb dyes and inks easily. The Pre-treatment of the Fabric was done by washing the fabric with detergent and clean water, and then dried on the line. The fabric was pre-washed to make sure that it is clean of any surface treatment that will keep away textile ink from adhering.

The fabric was stretched and masked on the printing bed flat without any bubbles of trapped air. The fabric was gridded to the size of stencil with the help of twine to allow perfect placement of stencil inside the grid. The easiest way to apply paint to a large area is to cut lump of foam and roll it with the aid of masking tape to form a round shape with a size controllable on the stencil; the size of the foam depends on the size of the pattern. Another medium is the use of brushes; the size of the brush also depends on the size of the pattern or design.

The next stage was the application of the textile inks, starting from the lightest of the choice of colour, to the darkest shade. The lump of foam is picked up by the non-folded edge. Using either a paint tray, a few paper plates taped together, or a piece of waxed paper, large pools of the colour(s) of fabric paint (textile inks) to be used for the printing is poured. The folded edge of the foam is pressed into the textile ink, and it's used to blot the textile ink onto the fabric. The paint will be prevented from being rubbed on the surface, so as to avoid the ink from smearing. The printing shall commence on the edges of the stencil, working into the centre, rather than from the center to the edges. Again this helps prevent paint getting under the edges as it is less likely to accidentally bump the brush or lump of foam against an edge.

Overloading the brush or lump of foam with paint is avoided as it'll seep under the edges of the stencil. The brush lightly loaded, so that the ends of the bristles are covered evenly; excess inks are wiped off on a piece of paper or cloth. Better results are gotten by applying two thin coats rather than one thick one. The first coat is applied and left to dry before applying the second. The stencil is kept by taping it at the top and bottom with a piece of tape. Low-tack tape is best as it's very easy to remove and wouldn't pull off any paint from the surface. To use more than one color in a stencil, tape will be used to mask off areas of the stencil that is not needed for a particular color and if various stencils together are to be used together, it was first tried on a piece of paper.

3.7 End Uses

After the printing production, to ascertain the functionality of the produced design, end products were produced. The following products were executed at the end of the printing production of the fabric. Production of:

i. Bedding accessories: quilted duvet, pillow cases and throw pillows.
ii. Quilted wall hanging.
iii. Quilted table cover.
iv. Curtains for doors and windows as well as for space decoration.

3.7.1 Quilting Techniques

Quilting is a sewing method done to join two or more layers of material together to make a thicker padded material. Quilting can be done by hand, by sewing machine, or by a specialist long arm quilting system. Laurel (1993), stated that "the process of quilting uses a needle and

thread to join two or more layers of material to make a quilt. Typical quilting is done with 3 layers: the top fabric or quilt top, batting or insulating material and backing material. The quilter's hand or sewing machine passes the needle and thread through all layers and then brings the needle back up. The process is repeated across the entire area where quilting was needed. A rocking, straight or running stitch is commonly used and these stitches can be purely functional or decorative and elaborate. Quilting was done to create bed spreads, art quilt wall hangings, clothing, and a variety of textile products".

3.7.2 Transferring the Quilt Design

There are many methods as well as marking tools available for use on quilts.

a) Tracing

This method works best with light-colored fabric and allows all designs on the quilt top to be marked prior to basting the quilt together. Select a quilting design. If necessary, darkly trace onto paper so that designs show through when fabric is positioned over it. A light source placed under the design can help to make it more visible. A light box or sunny window works well. To create a light box, place a lamp (shade removed) under a glass top table. Tape the paper pattern to the glass top. Place the fabric area to be marked over the pattern and trace with a pencil. Reposition fabric as needed to complete design transfer. Mark fabric with a thin, light line. Markings should not be visible on finished products.

b) Stencil or Template

There are other transfer methods available that allow the quilt to be marked after it was basted. Stencils or templates can be used for this purpose and work well on darker fabrics. Also, marking

designs just before quilting keep lines from fading out or rubbing off. Plastic stencils can be purchased with precut slits forming design. Simply position stencil over fabric area to be quilted and mark through the slit openings to transfer pattern.

Mark dark fabric with white or yellow pencil; light fabric with No. 2 pencil, pumice powder or chalk. Sheets of blank template plastic or lightweight cardboard can be used for creating original designs. Transfer designs onto template and use scissors to cut out shape. Position this template on quilt surface and lightly trace on fabric, then quilt area. Precut paper patterns can also be purchased. These can be used repeatedly several times.

c) Freezer Paper

Freezer paper makes an excellent, inexpensive template. Place freezer paper, dull side up, over design and trace. Cut out freezer paper shape and place waxy side of template against fabric. Apply hot, dry iron two to three seconds over paper. The waxy side of the paper temporarily adheres to the fabric. Trace around paper. After marking shape, peel off fabric and reposition for multiple markings.

d) Masking Tape

Masking tape can be used on fabric for straight-line quilting. Position the tape on the fabric and hand- or machine-quilt next to the tape's edge. Tape can be removed and repositioned over and over

3.7.3 Machine Quilting

Machine quilting is much faster than hand quilting. It is based on the following procedures.

a) Work Area

It is important to have a good chair, preferably one that supports the back well. The sewing machine needs to be at a comfortable height and on or adjacent to a large-sized table with plenty of room to support the quilting project, especially if the project is large.

b) Preparations

The machine quilt project needs to be basted more closely than with hand quilting. The quilt will be manipulated and handled more with machine than with hand quilting. Fabrics are more likely to shift and wrinkle if they are not basted closely.

Sewing machine needle that is appropriate for the fabric quilting must be selected. For cotton fabric and mid-loft batting, #12/80 is suggested. Cotton thread is preferable. If the quilt has many different colors, as most do, a color that coordinates or matches one of the colors is chosen. It is good to choose a thread color that will "disappear" or blend into the backing fabric. White is almost always acceptable. Clear, transparent nylon thread is also an option for machine quilting.

It is important to use the sewing machine that has the optional "needle down" feature. If not available, the stitching is ended with the needle in the down position. This ensures straight quilting lines. Practice sewing on scraps of the quilt sandwiches before starting to quilt the actual project itself.

3.8 Analysis

The research questions of this study helped in the findings of this study. The materials and methods used were discussed; the steps taken and procedures involved during the studio practice as well as the results were analyzed and discussed.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This section deals with the discussion and documentation of the results of the studio practices conducted in the cause of this study and also the findings derived from the study. The findings of this study were derived through the research objectives and research questions and were discussed within the context of the procedures and production.

4.2 Results

4.2.1 Printing production of the wall hanging and table cover design

The design was made of four colours namely: Orange, lemon green, army green and blue. The background colour was a marbled design from the tie-dye technique. After the fabric has been pre-treated, it was marbled in a metal plate and dye was sprinkled on it to achieve the marbled effect. The dyed fabric was left in the metal plate for some minutes for oxidation, that is, penetration of air so as to retain the dye colour on the fabric. After some time, the dyed fabric was spread on the line for further oxidation, after which the fabric was rinsed in clean water up to three times to remove the excess chemicals and dyes. The fabric was left to dry on the line and was later ironed with electric pressing iron.

The next stage is the application of textile inks (printing) on the achieved background effect. The printing commenced with the lightest of the colours on the design which is orange, followed by

lemon green colour, blue colour and finally the army green colour as seen in 7a, b, c, d, e, and f below.



Plate 7a: Marbling the fabric

Source – The researcher (2016)



Plate 7b: Dye Application

Source – The researcher (2016)



Plate 7c: Marbled effect

Source – The researcher (2016)



Plate 7d: Application of 1st and 2nd colour

Source – The researcher (2016)



Plate 7e: Application of 3rd and 4th colour

Source – The researcher (2016)

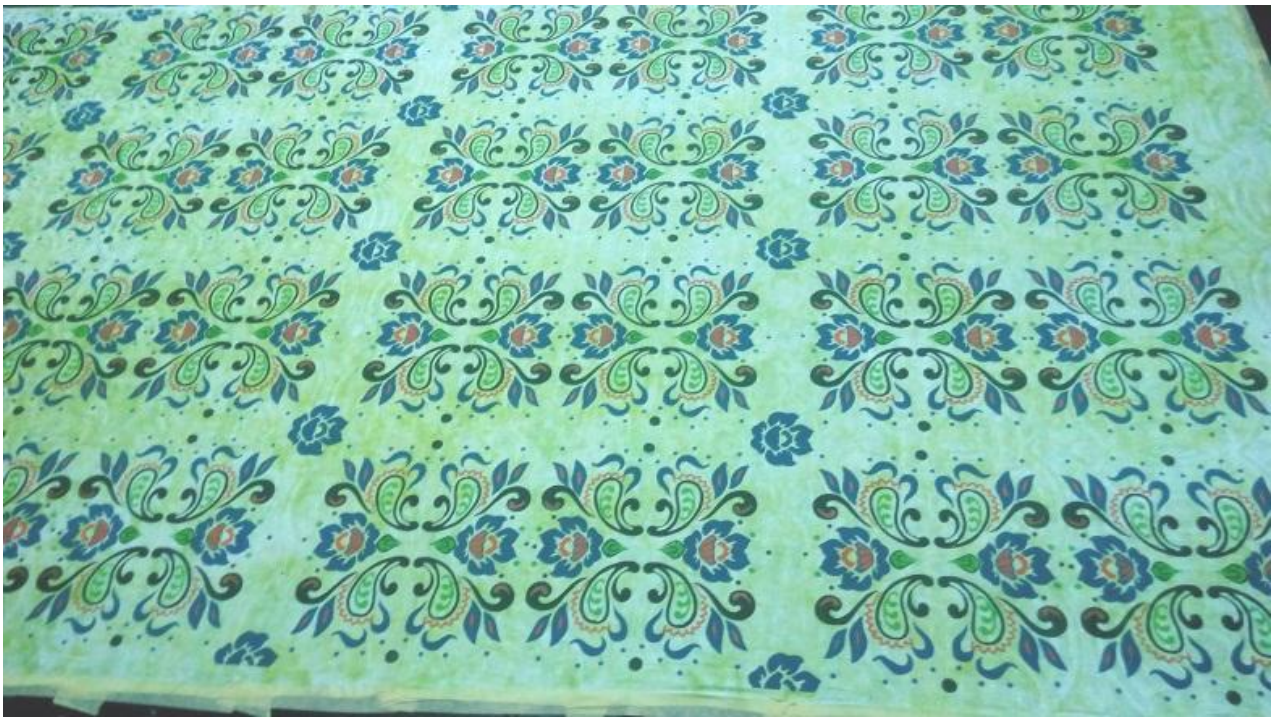


Plate 7f: Final Colour

Source – The researcher (2016)

4.2.2 Printing of the curtain design (Doors and windows as well as for wall decoration)

The curtain design comprised of four colours namely: lemon Green, wine, army green and orange. The background colour was designed with the lemon green colour which was applied on

a circle shape manipulated with a set of compass on the painting design and designed using the circle shape tool on CorelDraw design package for the computer generated design.

The printing of the designed commenced with the background design which appeared in lemon green, after which the lightest colour, orange on the design was applied. Thereafter, the design with the wine colour was applied followed by the darkest colour, army green as seen in Plates 8a, b, c, d, e, f, g, and h below.



Plate 8a: Background colour

Source – The researcher (2016)



Plate 8b: Background colour

Source – The researcher (2016)



Plate 8c: 1st colour

Source – The researcher (2016)



Plate 8d: 2nd and 3rd colour

Source – The researcher (2016)



Plate 8e: 3rd colour

Source – The researcher (2016)



Plate 8f: Final Colour

Source – The researcher (2016)



Plate 8g: 1st and 2nd Colour

Source – The researcher (2016)



Plate 8h: 3rd Colour

Source – The researcher (2016)

4.2.3 Printing of the bedding accessories (Bed Spread, throw pillows, pillow cases)

The design comprised of five colours namely: cream, orange, lemon green, Prussian blue and brown. No background colour was intended for this design; the printing of the design commenced with the lightest of the choice of colour which is the cream colour after which the orange colour was applied. The next colour that followed was lemon green because it has come before the prussian blue colour due to the nature of the design, thereafter, the prusssian blue was applied and finally the darkest colour, brown was applied as seen in Plates 9a, b, c, d, e, f, g, h, I, j, and k below.



Plate 9a:1st, 2nd and 3rd colour

Source – The researcher (2016)



Plate 9b: 4th colour

Source – The researcher (2016)



Plate 9c: 4th colour

Source – The researcher (2016)



Plate 9d: 4th colour

Source – The researcher (2016)



Plate 9e: Before and After Blocking of Bridges

Source – The researcher (2016)



Plate 9f: 4th colour

Source – The researcher (2016)



Plate 9g: 4th colour

Source – The researcher (2016)



Plate 9h: 4th colour

Source – The researcher (2016)



Plate 9i: 4th colour

Source – The researcher (2016

4.3 Home Textiles End Use Products

4.3.1 Patterning and production of quilted wall hanging and table cover

A quilted wall hanging and table cover was designed and produced at the end of the printing production of the design on the fabric. The machine quilting method was employed and straight stitches were used in the quilting process. After the quilting process, the wall hanging design was framed with a wooden frame and the table cover was designed as seen in plate 9a and 9b below.



Plate 10a: Quilted wall hanging

Source – The researcher (2016)



Plate 10b: Quilted Table Cover

Source – The researcher (2016)

4.3.2 Patterning and production of curtains

At the end of the printing production of the curtain design, the designed fabric was patterned with the addition of another plain fabric which was chosen to enhance the aesthetics and craftiness of the fabric as seen in plate 11a and 11b below.



Plate 11a: Demarcation Curtain

Source – The researcher (2016)



Plate 11b: Door and Window Curtains

Source – The researcher (2016)

4.3.3 Patterning and production of quilted bedding accessories

Bed cover, throw pillows and pillow cases were patterned and quilted to enhance the beauty of a bedroom setting. The bed cover was patterned and quilted with another material (foam) which was used as the substitute for fibre sheets to enhance the quality of the production. Foam was placed in-between the upper fabric and the lower fabric and sewing machine was employed for the joining of the three layers together. The throw pillows were also patterned and quilted with foam using the machine quilting method as seen in plates 12a, b, and c below.



Plate 12a: Quilted Bedding Accessories

Source – The researcher (2016)



Plate 12b: Quilted Bedding Accessories showing the inner

Source – The researcher (2016)



Plate 12c: Quilted Bedding Accessories showing the inner

Source – The researcher (2016)

4.3.4 Heating of the printed fabric

Teflon Paper was employed to improve the quality of the colour impression on the fabric, it was placed over the textile inks and electric pressing iron was employed as the heat source of heating the designs for about 10 seconds. Teflon paper also helped in giving the fabric a glossy look and feel as seen in Plates 13a and 13b below.



Plate 13a: Heating of the Fabric with Teflon Sheet

Source – The researcher (2016)



Plate 13b: Heating of the Fabric with Teflon Sheet

Source – The researcher (2016)

4.4 Findings and Observations

The following findings and observations were recorded based on the experiments conducted in the studio by this study:

1. The use of computer software enhanced the precision of the motifs and designs as it was carefully traced and edited and then moved around with certain tools and elements on the computer. There was no difference in all the motifs used on a unit of design.
2. It was observed that the use of computer software enhanced the ease in the repeat patterns of the designs. It helped in the easy movement of the design and repeated carefully on the computer.
3. The application of paper sticker on the stencils helped in achieving precision while developing the stencils and also prevented the stencil from getting soaked while applying textile inks on the fabric.
4. It was equally observed that leaving the textile inks to ferment for certain period enabled the smoothness of the ink and also the smooth application of the inks on the fabric. No particles of inks were experienced during the course of the printing production.
5. It was observed also that the heating of the fabric with the aid of Teflon sheet improved the quality of the colour impression on the fabric and also gave the fabric glossy look and feel.



Plate 14a: Displayed works

Source: the researcher (2017)



Plate 14b: Displayed works

Source: the researcher (2017)



Plate 14c: Displayed works

Source: the researcher (2017)

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter is a summary of the entire study including the problems, objectives, procedures of the studio practice as well as the findings of the study, conclusion and recommendations.

5.1 Summary

The aim of this study was to achieve precision in the designing and registration of patterns for home textiles using a combination of digital technology and manual method of printing. Hence, the problem of the study was to ease the production of repeat patterns through the help of CorelDraw Design Package and Photoshop Element for easy drafting, tracing and conversion of patterns into lines after which the manually generated sketches might have been scanned into the computer. The common printing problems and challenges like over-exposure (loss of detail), misfitting of the designs, difficulty of registering screens, uneven ink deposits, colour smear, among others, was also treated in this study.

This study carried out a number of experimental works using stencils to produce printed fabrics which were later converted to some aspects of home textiles. The explorative study of digital technology with manual printing for home textiles was made possible by identifying suitable computer software's like CorelDraw design package and Photoshop element which were employed in the tracing and repeat of the motifs, developing stencils with special cutting tools, application of paper sticker on the stencils before embarking on the development of stencils, and

also the application of well fermented textile inks. All these were targeted at achieving the aim of the study which resulted in the findings.

5.2 Conclusion

Base on the findings of this study, the following conclusions were reached.

The combination of digital technology with manual method of printing ascertained precision in developing design concepts and repeat of patterns for home textiles with the he help of computer software's such as CorelDraw design package and Photoshop Element for drafting and tracing of the patterns. This helped in saving time and eased the stress of manual tracing on the light box. Application of paper sticker on the stencils aided the precision of the stencils development and also prevented the stencils from getting soaked with ink. The use of special cutting stencil tools such as dual cutter, cutting knife and circular cutter helped in achieving precision while developing the stencils. Colour impression on the fabric was improved with the aid of Teflon sheet which was used with hot iron to make the inks penetrate into the fabric fibres thereby ascertaining the quality of the colour impression. Home textiles end use products such as quilted duvet, quilted pillow cases, quilted throw pillows, quilted wall hangings, quilted table cover, curtains for doors and windows, curtains for space decoration were all displayed and exhibited for assessments of the design registration.

5.3 Contribution to Knowledge

This study will open a new vista of opportunities in the exploration of the combination of digital technology with stencil method of printing in order to achieve precision in the drafting and repeat of patterns which will result in the achievement of precision of pattern registration on the

fabric. The common printing problems and challenges like over-exposure (loss of detail), misfitting of the designs, difficulty of registering screens, uneven ink deposits, colour smear, among others, will be treated in this study. Also, as of present, there seems to be little record of the combination of digital technology with stencil method of printing for home furnishing fabrics. This study is very relevant as it will provide a written document on procedures of exploring the use of computer software in developing designs for producing stencils as well as highlight what materials can be used to enhance the stencils.

5.4 Recommendations

1. Further research effort could be geared towards the use of digital technology and manual printing for dress design as this study will be a guide for such research.

2. The researcher recommends that Computer Aided Design (CAD) should be added to the textile studio design curriculum.

3. This study had employed the use of CorelDraw design package and Photoshop element for the repeat patterns, further study can be carried out with other computer software for generating motifs and patterns.

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Online Resources

http://www.ibike.org/africaguide /textile/textile1.htm

http://www.artlandia.com/products/svmmetry/work/textile

http://www.adobe.com/produtcs/creative suit/design/?promoid=BPDDY (27/01/08)