# The Environment as a Resource for Screen Development in Second Cycle Institutions in Ghana

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*Abstract:*
*The development of screen printing has witnessed an enormous growth rate. From periods when simple hand operated machines were used and designs were solely made with hand drawing tools to the present day where computer software programmes have simplified and improved both designing and screen printing. It is therefore clear that, the upcoming designers who do not have access to computer and cannot draw properly are left to their faith. It is for this reason that this paper explores the possibility of selecting ideas (shapes) from the environment (natural and man-made) and manipulating them into suitable designs for screen printing.*
*The step-by-step procedures used in organizing the ideas, developing the screens and printing the sample fabrics as well as systematic presentation of the results and appreciation of the final products were recorded in this paper. The study shows that ideas in the environment can be manipulated and carefully organized into interesting designs textile printing. The researchers adopted the experimental and descriptive research method based on the qualitative approach for the study. Experimentation with the selected objects revealed their suitability for using them for screen development and printing of sample fabrics.*

*Keywords: Textiles, Screen printing, Environment, Screen development, Textile design, Natural and Artificial objects*

## 1. Introduction

Textile printing is the most versatile and important of the methods used for introducing colour and design to textile fabrics. It is a process of bringing together a design idea, one or more colorants, and a textile substrate (usually a fabric), using a technique for applying the colorants with some precision (Leslie, 1994).Screen printing is one of the oldest methods used in decorating textiles and printing of other suitable mediums for everyday use. Screen printing is the most versatile of all printing processes. Since rudimentary screen-printing materials and equipment are so affordable and readily available, it is used in every part of the world. Screen printing has undergone the various stages of development to the present day computerization. There are different types of screen printing methods but the widely used in the educational institutions in Ghana is the hand flat- bed type; this is due to its low cost of production. The uses of ideas derived from the environment in developing a screen and the subsequent printing is not popular, though, some authors have documented evidence about the process. The traditional way of preparing a design or pattern for developing a screen is by painting or coating the di-positive with black ink and it should be done with precision and care. The coated areas or the black ink prevent the penetration of light rays from developing those parts of the screen. It is therefore evident that, any object with interesting and suitable shape which is not transparent could be used in developing a screen. This research aimed at random selection of ideals from the environment (natural and man-made), then organise or compose the selected ideas into a suitable repeat pattern for screen development and printing of sample fabrics. The study employed experimental and descriptive approaches using observation as the main instrument for collecting data. It was observed that, the ideas derived from the natural and man-made environment produce good and interesting designs.

## 1.1. Printing

Hall (1980) states that, printing is a means of producing more colourful effects on fabrics and also on yarns. This implies that, printing can be done before and after weaving, depending on the desired effects. The emphasis is that, the effects should be colourful. It is therefore clear that apart from constructed fabrics, fibres and yarns can be printed on. Wynne (1997) is of the view that, printing is the localized application of dyes or pigments in a thickened form to a substrate, to generate a pattern or design. This however shows that, dyes or pigments used in printing should be in a paste form to resist it from spreading. Printing in this context can be done on any surface provided it is suitable for dyes or pigments.

Welford (1966) opines that, printing is the method of imposing coloured designs on the surface of cloths. This is an opposing view to Hall and Wynne in that, printing is focused on imparting designs onto cloth surfaces only. Meanwhile, printing can be effected on other forms of textiles such as fibres, yarns and garments. Tortora (1992) stated that, printing is the application of a pattern to fabric by the use of dyes, pigments or other coloured substances. Printing in this sense is based on application of coloured substance regardless of their fastness properties. Tortora and Wynne share the same view and consider printing as application of colourants to obtain patterns. Gupta et al (1999) agree that, printing is application of colour in the form of a design. Printing is therefore not limited to fabric but any other suitable medium which will accept colour of any kinds in a form of design regardless of their fastness properties. Storey (1992) opines that, the term printing is used to indicate the patterning of cloth by means of printing, dyeing or painting. Printing in this regard includes any form of patterning a fabric for a specific end use. This goes beyond the field of textiles and embraces any art form that produces patterns on fabric using any colourant.

Clarke (1977) describes printing as the means of transferring the creative talent of the designer to the cloth. The designer always has to create the design on a different medium and later transfer it onto a fabric. Phyllis et al (2005) maintain that, printing is the application of colourants in definite, repeated patterns to fabrics, yarns or sliver by any one of a number of methods other than dyeing. Colourant is deposited in thick paste form and treated with steam or chemicals to cause it to migrate into and adhere to the textile material. The design is not woven or knitted into the cloth but applied after the cloth is made. Printing can therefore be done at any stage of textile manufacturing. The stage at which printing will be done will depend largely on the effect desired in the final fabric.

## 1.2. Screen Printing

Screen printing is one of the methods used in transferring patterns or designs onto fabrics. Various authors have different views regarding its meaning. Hall (1980) is of the opinion that, screen printing is really a development of stencil printing, where the letters or numbers are cut out of a sheet, and colour dabbed through by means of a brush. He further stated that, in the modern form of screen printing, each ordinary stencil is replaced by silk or wire mesh fabric fastened across a square or rectangular wooden frame. This explanation of screen printing best describes the flat-bed screen printing technique, since square or rectangular wooden frames are used in screen preparation. Presently, there exist other forms of screen printing which do not need square or rectangular wooden frame for screen preparation and printing.

According to Wynne (1997), screen printing is basically a form of stencil printing. The screens consist of a synthetic fibre or metal gauze stretched taut over a frame. Parts of the gauze have the holes blocked off (non-printing areas); the printing paste is forced through the open printing areas by a rubber or metal blade called squeegee, and on to the fabric beneath. Wynne is in support of Hall's view on screen printing as they consider it as a form of stencil printing. This is because during printing, printing paste is forced through an opening onto the fabric.

Tortora (1992) opines that, screen printing is a method of applying coloured design on to fabric that is done either by hand or by an automated process. This implies that any form of application of coloured design onto fabric regardless of the medium and device used can be termed as screen printing, but this is not always the case. Screen printing, silk screening or serigraphy is a printmaking technique that uses a woven mesh to support an ink blocking stencil. The attached stencil forms open areas of mesh that transfer ink as a sharp-edged image onto a substrate. A roller or squeegee is moved across the screen stencil forcing or pumping ink paste through the threads of the woven mesh in the open areas. A screen print or serigraph is an image created using this technique.

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 process can print on substrates of any shape, thickness and size.

Tortara et al (2005) assert that, screen printing is the method of printing whereby the pattern is blocked out on a mesh fabric or screen so that when the colour is squeezed through it will penetrate the unblocked areas. The colour paste is forced through the screen by a squeegee. The various methods used in blocking out a pattern for screen preparation are photographical, lacquering and stencil method. Metal, rubber and wooden squeegees are mostly used in screen printing process and uniform pressure should be applied on the squeegee during printing.

Allen (1982) agrees that screen printing is a method whereby a closely meshed screen is placed in contact with the fabric to be printed, and the print paste is forced through the screen. It is evident that mesh plays a vital role in field of screen printing be it industrial or small scale industries. Synthetic fibre meshes are used for small scale industry screens while metal mesh is for the industrial screens. The fact is that industrial screens need to be stronger than small scale industrial screens because they are use in printing a lot yardage.

*1.3. Screen Development*

The success of screen printing depends absolutely on the development of the screen. A good and well developed screen will aid a smooth printing process; likewise, improper developed screen will make printing difficult or impossible especially if the fabric will be printed with two or more colours. The pattern or design to be developed should be coated or painted carefully and evenly with opaque ink - black is commonly used – and the edges of the designs should be sharp. The mesh should be stretched evenly and taut onto the wooden frame; the mesh should be washed properly; even coat of photo emulsion should be applied to the screen and dried properly in the dark room. The design and screen should be in firm contact at the time of transferring the design onto the screen; during screen development, it should be washed gently.

Storey (1992) argues that since the patterns are painted by hand on to a plastic film or kodatrace and the screen developed directly from this, it follows that there is virtually nothing that can be painted on paper that cannot be screen printed on cloth. She further stated that screen printing affords the creative and imaginative designer the means of putting or printing on cloth extremely varied ideas and effects. It is therefore clear that screens were used in printing intricate designs than other methods of printing. Educational Institutions and small scale industries which depend heavily on screen printing use white papers such as bond or A4 sheet in designing and developing their screens. The papers are treated with oil to render them transparent and this is considered cheap and convenient.

Adu-Akwaboa (1994) agrees that, after the tracing, the positive parts of the design are painted very well with opaque ink or black ink avoiding translucent areas and light penetration. The painting of the pattern or the design depends on the part which should appear in colour. The positive part of the design is painted black when that part is to appear in colour, the negative part of the design is painted black when the background is to appear in colour.

Clarke (1977) states that the pattern to be produced is painted on transparent paper with a dense opaque ink. The painting of the pattern with the opaque ink is to prevent light penetration through those areas. Since the coated screen is sensitive to light, the painted parts of the design will block the light rays from touching the screen during screen development. This is a common method for transferring a design onto a screen whether flat or rotary. With the advent of computer, designs are printed rather than hand painted with opaque ink. Black ink works better on bond paper than on tracing paper. The industries have a special film which is used for the preparation for screens hence there is no need for painting of patterns or designs.

*1.4. Environment*

The natural environment, commonly referred to as the environment, is a term that comprises all living and non-living things that occur naturally on earth or some part of it (e.g. the natural environment in a country). This term includes a few key components:

1. Complete landscape units that function as natural systems without massive human intervention, including all plants, animals, rocks, etc. and natural phenomena that occur within their boundaries.

2. Universal natural resources and physical phenomena that lack clear-cut boundaries, such as air, water, and climate, as well as energy, radiation, electric charge, and magnetism, not originating from human activity.

The natural environment is contrasted with the built environment, which comprises the areas and components that are heavily influenced by man. A geographical area is regarded as a natural environment, if the human impact on it is kept under a certain limited level. This level depends on the specific context, and changes in different areas and contexts. The term wilderness, on the other hand, refers to areas without any human intervention whatsoever or almost so which may be dangerous to human life.

The social environment, also known as the milieu, is the identical or similar social positions and social roles as a whole that influence the individuals or a group. The social environment of an individual is the culture that he or she was educated and/or lives in, and the people and institutions with whom the person interacts. A given social environment is likely to create a feeling of solidarity amongst its members, who are more likely to keep together, trust and help one another. Members of the same social environment will often think in similar styles and patterns even when their conclusions differ, (Environment, 2008)

**2. Materials and Methods**

The aim of the study is to select suitable ideas (objects) from the environment, develop screens from them and print sample fabrics. The researchers adopted the experimental and descriptive research methods based on the qualitative research approach for the study. Best (1981) opines that the qualitative research study is the type in which the description of observations is not ordinarily expressed in quantitative terms. This is not to suggest that numerical measures are never used in qualitative research, but it is not largely dependent on numbers. This implies that the qualitative research approach is usually based on quality rather than quantity as used in this project. Ary et al (2002) are of the view that qualitative research method investigates the qualities of relationships, activities, situations or methods within a given context.

Owing to the heterogeneous nature of the population, the researcher used simple random sampling to select the population for the study. This sampling technique was used since the population falls into distinctly different categories. The random sampling gave the researchers the opportunity to randomly select samples from flora, vegetables, cereals, fishes and inanimate objects. The criterion for selecting the population is that the object (natural and man-made) should possess interesting shapes and features.

> ➤ Category A – Flora (flowers and leafstalks).
> ➤ Category B – Vegetables (onion).
> ➤ Category C – Cereals (rice).
> ➤ Category D – Fish (fishtails).
> ➤ Category E – Inanimate objects (plastic pegs, razor blades, cotton swabs).

*2.1. Development of Screens*
This section deals with the sequence through which the screens were produced. Suitable and interesting ideas (objects) both natural and man-made were carefully selected and manipulated at the various stages to achieve the desired and best results. The main processes which were adopted for production of the screens are as follows;

- Selection of object.
- Preparation of wooden frame.
- Stretching of mesh onto wooden frame.
- Coating and drying of screen.
- Manipulation of objects.
- Development of screen.

Photographical (electricity) screen development technique was used and ten (10) minutes was used as exposure time for all the screens.

2.1.1. Developing Screens from Cocoyam Leafstalk



*Figure 1: Cocoyam leafstalk arrangement and developed screen*

2.1.2. Developing Screens from Flamboyant Flower



*Figure 2: Flamboyant flower arrangement and developed screen*

2.1.3. Developing Screens from Plantain Flower



*Figure 3: Plantain flower arrangement and developed screen*

2.1.4. Developing Screens from Vegetables (Onion)



*Figure 4: Onion slices arrangement and developed screen*

2.1.5. Developing Screens from Cereals (Panicle of Rice)



*Figure 5: Panicle of rice arrangement and developed screen*

2.1.6. Developing Screens from Fish (Fish tails)



*Figure 6: Fish tail arrangement and developed screen*

2.1.7. Developing Screens from Inanimate Objects (Plastic Pegs)
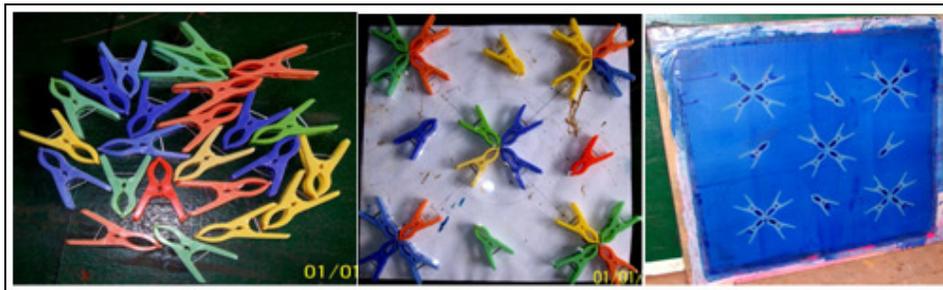


*Figure 7: Plastic pegs arrangement and developed screen*

2.1.8. Developing Screens from Inanimate Objects (Razor Blade)
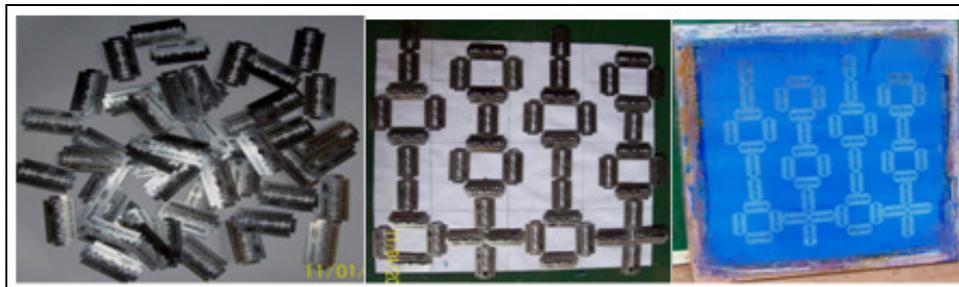


*Figure 8: Razor blade arrangement and developed screen*

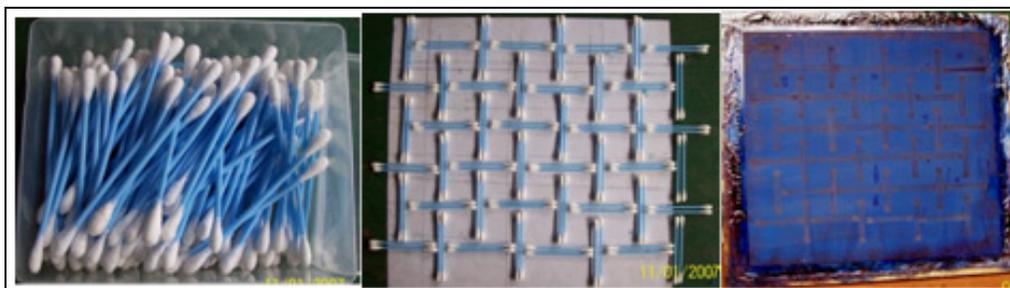2.1.9. Developing Screens from Inanimate Objects (Cotton Swabs)



*Figure 9: Cotton swabs arrangement and developed screen*

## 3. Results and Discussions

### 3.1. Printed Fabric from Cocoyam leafstalk
The sample fabric (Figure 10) is a composition of the cocoyam leafstalk. The motifs are organized into a semi-circle which served as a unit repeat of the design. The motifs are printed in dark violet onto a light brown and lemon green marbled background and the motifs are arranged in an alternating upside-down pattern in horizontal line.
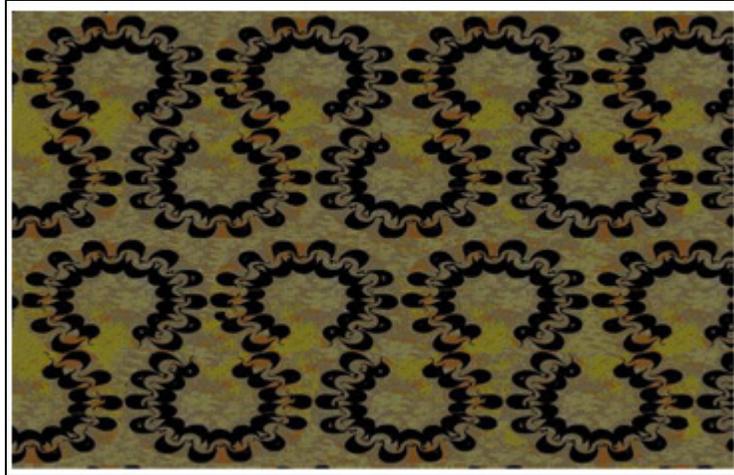

*Figure 10: Final fabric print of cocoyam leafstalk design*

The colours are in harmony with each other. Though there are no textures, there is a good blend between the motifs and the background. The unit design repeated perfectly as desired. The print is good for curtains and ladies African wear due to the motif arrangement and the elaborate nature of the motifs.

### 3.2. Printed Fabric from Flamboyant Flower
Figure 11 is a fabric which was produced using the petals and sepals of the flamboyant flower. The motifs are organized by placing three petals together to form a repeat pattern. Two of the petals at the sides are pointing to the same direction and the one in the middle, pointing to the opposite direction. The general arrangement of the motifs is in half drop pattern and the sepals are randomly placed in between the motifs. The motifs are printed with black on a sea blue background and there is no difficulty inrepeating the units of the design. The print is suitable for shirting and dressing fabrics; it is also good for curtains and children's wear in view of the small size of the motifs.
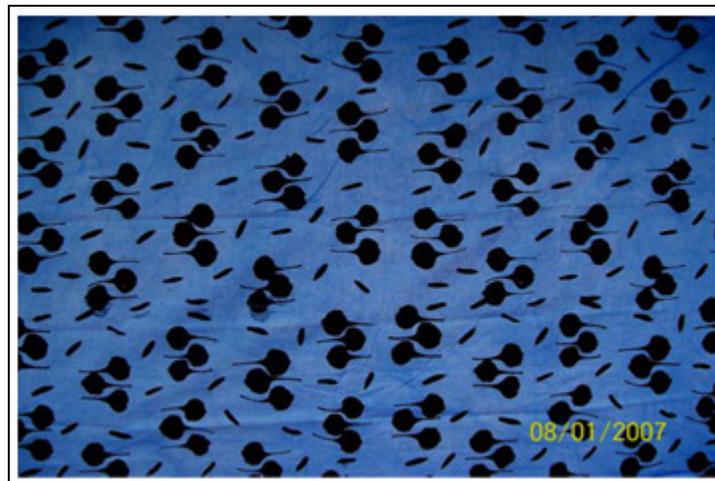

*Figure 11: Final fabric print of flamboyant flower design*

### 3.3. Printed Fabric from Plantain Flower
The objects are arranged into a circular pattern. Four of such patterns formed a unit repeat of the design, with few of the objects randomly placed in between them. The motifs are printed in dark brown onto a background of dark yellow in full drop repeat pattern. There is no difficulty in repeating the unit repeats of the design and the colours (coffee brown and dark yellow) are in harmony to each other. The print is suitable for shirting and dressing fabrics and could be used for curtains and table cloths.

*Figure 12: Final fabric print of plantain flower design*
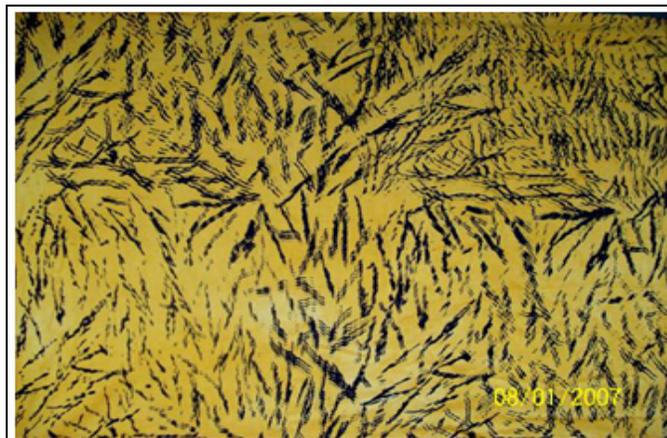
### 3.4. Printed Fabric from Onion

The motif for the fabric (Figure 13) was derived from onion. The unit repeat was organized based on half drop arrangement to produce scaly effect. The motifs are printed with dark violet on a light brown background. The unit repeats of the design repeated and joined perfectly. The fabric is suitable for mummy cloth because of the motif arrangement and could also be used for African wear and background texture for elaborate motifs.


*Figure 13: Final fabric print of Onion slice design*

### 3.5. Printed Fabric from Panicle of Rice

The motifs are arranged based on all over repeat pattern with the motifs pointing to all directions so there is no definite unit repeat for the print. The motifs are printed in black on a yellow background with no texture and colours are in harmony with each other. There is no problem in repeating the unit repeats of the design and the print is good for shirts, dresses and a background texture.


*Figure 14: Final fabric print rice (panicle) design*

### 3.6. Printed Fabric from Fish Tails

The fabric in Figure 15 is produced using fishtail as the motifs. Three of the motifs are organized into triangular shape which served as the unit repeat of the design with single ones placed in between them. The motifs are printed with black on a golden yellow background without textures in all-over repeat pattern and the unit repeats of the design joined perfectly well. The print is suitable for dresses and shirts considering the size (small) of the motifs and can be used as a texture for elaborate motifs.
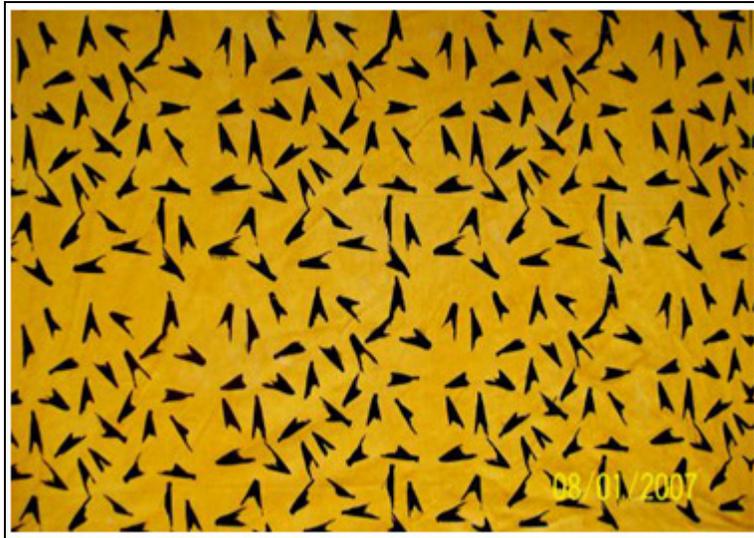


*Figure 15: Final fabric print of Fish Tail design*

### 3.7. Printed Fabric from Plastic Pegs

The fabric (Figure 16) is produced using plastic pegs as the motif. Four of the motifs are arranged with their heads meeting at a point and five of such arrangement with single ones in between them formed a unit repeat of the design. The fabric is printed with red on a light blue background based on full drop repeat pattern. The unit repeats of the design joined perfectly with no difficulty. The print is suitable for children's wear and curtain due to the brightness of the print.



*Figure 16: Final fabric print of Plastic Pegs design*

### 3.8. Printed Fabric from Razor Blades

This fabric (Figure 17) is produced using razor blades as the motifs. Four of the objects are arranged into square with another four joined to form a cross placed on top. Three of such arrangement formed a unit repeat; the objects are organized based on half drop repeat pattern. The motifs are printed with brown on light green background without textures and the unit repeats of the design repeated perfectly. The fabric is good for shirts and dresses.
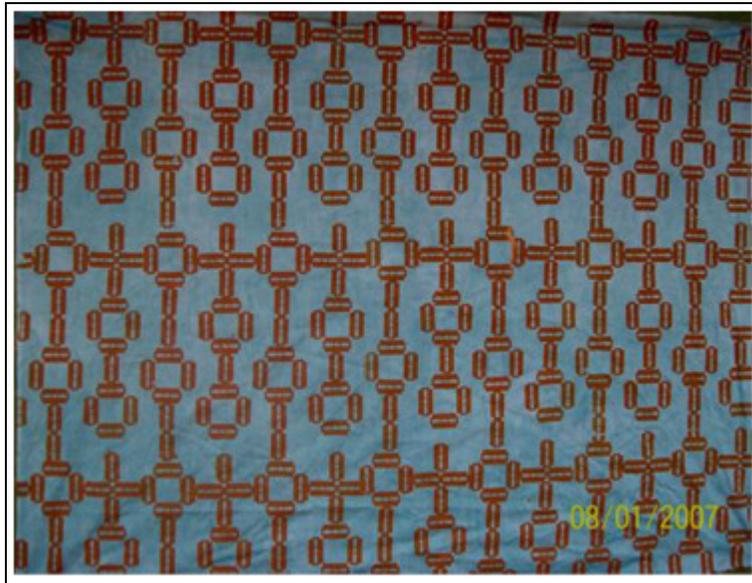
*Figure 17: Final fabric print of Razor Blade design*

*3.9. Printed Fabric from Cotton Swabs*
Two of the objects are placed horizontally with another placed vertically in between them. The motifs are organized into half drop repeat pattern and printed with blue-black on orange background with no textures but the colour harmony is good. The unit repeats of the design joined well. The fabric is suitable for dresses, shirt and curtains and can also serve as background texture for other motifs.
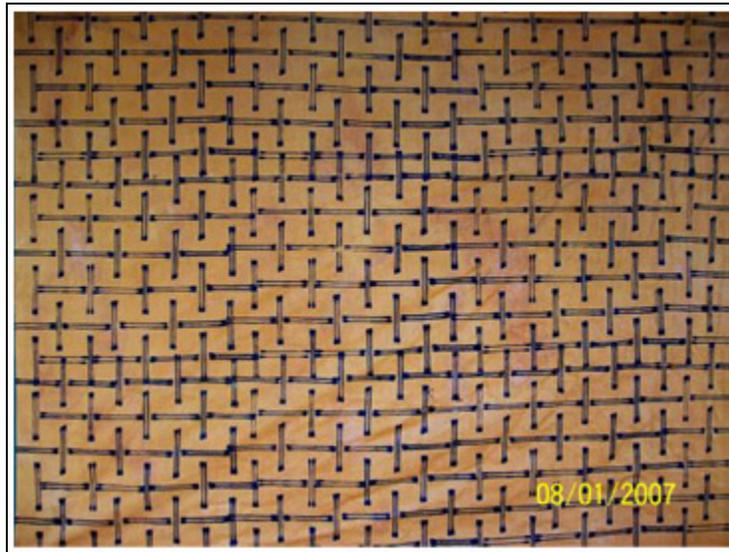

*Figure 18: Final fabric print of Cotton Swabs design*

The main findings are as follows;
    i. Any type of objects can be used for developing screen regardless of their colours.
    ii. Wet objects can be used successfully in developing screens.
    iii. Objects can be manipulated into interesting patterns and designs within a short period.
    iv. The objects (ideas) obtained from the environment could be employed in printing any type of fabrics for a specific end-use.
    v. This method of screen developing is good for designers who have good sense of colour.
    vi. The method is limited to use of two- dimensional objects.
    vii. Multi- coloured prints can be achieved by super imposing colours and also by employing the shift technique.

**4. Conclusion**
The results of the study have revealed the possibilities of using ideas from the environment in developing screens for textile printing. The success of the study is a motivation for textile students and designers to explore this technique of screen development for printing interesting fabrics. The study highlights creative development and use of skills and understanding of motif arrangement. Screen

printing involves critical observation and careful manipulation of motifs, tools and equipment used for the various processes. The objects (ideas) obtained from the environment could be employed in printing any type of fabrics for a specific end-use.

The study also revealed the following; interesting designs can be printed within a short period and this will save cost and time, wet objects can be used successfully in screen development, this method of screen development require a good sense of colour since designs are not painted, this method of screen development is suitable for three dimensional objects and designing is no longer a preserve for those who are skillful in drawing. The researchers concluded that objects (ideas) sourced from the environment can be used straight away in developing screens without drawing them.

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