Construction of a Screen-Printing Machine for Students in Fine and Applied Arts Department

[1]Dr. (Mrs.) Madumere Ifeoma Perpetua, [2]Ewa Christabel Ifeoma (MFA), [3]Sylvester Asuelimen Ofeimu

[1]H.O.D, Fine and Applied Arts Department, School of Secondary Education (Vocational), Federal College of Education (Technical) Asaba.

[2,3]Department of Fine and Applied Arts, School of Secondary Education (Vocational), Federal College of Education (Technical) Asaba.

DOI: https://doi.org/10.47772/IJRISS.2026.100700767

Received: 28 July 2026; Accepted: 03 August 2026; Published: 12 August 2026

ABSTRACT

Fine and Applied Arts is a critical component of vocational and technical education. It emphasizes creativity, self-expression, and the development of practical skills among beneficiaries. In an era where employability and skill acquisition are paramount, institutions are increasingly focusing on hands-on learning experiences that go beyond theoretical instructions. Many Fine and Applied Arts students struggle to transits from theoretical learning to the mastery of practical techniques, often due to inadequate access to functional equipment. One of such practical components in art education is screen printing, a technique widely used for producing artistic and commercial designs on various surfaces, including fabric, paper, and plastic. This study focused on the construction of a screen-printing machine in Fine and Applied Arts Department at Federal College of Education (Technical) Asaba with the aim of providing students with a practical tool for printing production. The availability and use of screen-printing machines contribute towards improving students' practical skills and artistic expression in Fine and Applied Arts. The design employed in this study was triangulation or mixed design. The production started with detailed sketches, later developed into constructed parts and fabricated parts by dimensions and designs. The exercise was carried out by researchers with the help of support and technical assistants. By constructing a Screen-Printing Machine designed for educational purpose, this study sought to promote hands-on-learning and improve learning experiences of students.

Keywords: Construction, Screen-printing, Machine, Students, Fine Arts

INTRODUCTION

Screen-printing or silk-screening and serigraphy is the process by which ink is pushed through a fine mesh or screen that is mounted in a type of frame and onto a porous matrix such as paper or fabric. Screen-printing is a process where mesh is used to transfer ink / dye unto a substrate, except areas made impermeable to the ink by a blocking stencil (Russsell, 2016). There are many ways to create a successful screen print. Traditionally, there is some type of blocker applied to the screen so that ink will not go through. The areas where the image appears are not blocked, so ink is able to come through the screen. In standard screen printing, light sensitive emulsion is applied and the image is burned onto the screen. This process requires a dark room. However, stencils or other forms of blockers can be used on the screen once dark room is not required (Lastimosa, 2018).

Recently, various modern technologies are available to create more precise, complex, and commercially viable art works, but the traditional screen-printing machines are still preferred due to its potential unrestricted usage.

According to Daniel *et al*. (2009), serigraphy printing work has been a very lucrative trade, but over the years it has been facing restriction challenges due to importation costs.

History of Screen-printing

Screen-printing or serigraphy is the oldest form of printing, as its origins can be traced to prints such as woodcuts and block prints of the Song Dynasty (960–1279 AD), and later to the Japanese in the 15th century as a way of transferring designs to substrates (Laura, 2016). Simple stenciling techniques were used as a way to create imagery. As at that time stencils were cut out of paper and the mesh was woven from human hair with stiff brushes used to force ink through the mesh to the substrate (Laura, 2016). In the 17th century, silk screens were used in France as a way of printing on substrate. Stiff brushes were still being used as a way to push ink through the mesh. Thus, the practice of stretching silk over a frame to support stencils was initiated. Serigraphy was finally introduced to the West in the late 18th century, but became popular in the early 20th century, when silk mesh became accessible and profitable (Baines, 2019). Adeyeye (2020) noted that the printing industry development began as far back as 1854 with the excitement to bringing the Christian religion and education to Nigeria by early missionaries.

A group that formed the National Serigraphic Society first used "serigraphy" as a term to describe fine art created with this technique. This shift served to legitimized the technique in its two separate applications. The term came from Latin "sericum" (silk) and Greek "graphien" (draw or write). (Catherine 2011*).*

Serigraphy, otherwise known as screen-printing is arguably the most versatile of all printing processes as it can be used to print on a wide variety of substrates such as paper, paperboard, plastics, glass, metals, fabrics, and many other materials. Recently, there are electric printing machine and manual or traditional screen-printing machine.

Digital Printing machine (Electric)

Digital (DI) Printing machines use high-definition printing that provides excellent printing quality. A number of printing techniques are used depending upon the quality, volume of production, graphics, and complexity of designs. DI printing machines are ideally suited for publishing a small print run of posters and books with high clarity and quality but cannot work without electricity.

Trends in Screen-printing

Screen-printing is evolving and thriving in the 21st Century, steadily expanding to new markets and applications, as it continues to prove its unmatched versatility among commercial and industrial printing processes. Flexible and dependable, screen printing remains the dominant mass-imaging technology. Despite some advances in Digital (DI) printing technology in certain sectors of the industry, the adaptability and cost effectiveness of screen-printing, particularly in production environments, ensure its continued viability. Screen-printing machine cannot be pushed aside in modern day printing as a result of unstable power supply (Daniel *et al*., 2009). Luke (2022) notes that, the cost of automated serigraphy printer is between $32,000 to $87,500 which translates to ₦16,000,000 and ₦43,750,000 as at 8th June, 2021, excluding the payment of high duty on importation of foreign goods. Screen printing allows the application of thick ink or coating layers on a wide range of substrate which is one of the major advantages compared to other printing techniques. Beside the 3D visual effects, screen printing could be used for creating a 3D object (Komi, 2015).

Screen-printing Process

Screen printing is a stencil process where the printing involves closed non image areas and open image areas. In screen-printing, ink is forced through a screen by resilient squeegee. The screen-printing plate is a combination of screen and stencil (Kipphan, 2001). Today, screen frames are usually aluminum, wood and steel. Wooden Frames are commonly used for screen printing forms because of low cost, light weight, and ease of manufacturing. Process of screen printing is based on the principle of squeezing the ink through open areas of the mesh that have not been hardened and allow ink through. As the ink is squeezed by a squeegee from the inside of the mesh, it exits through the open mesh on to the substrate. All screen-printing machines are designed to follow this basic principle. Two basic construction types are flatbed and rotary system.

No Graphic or Textile teaching / knowledge is complete without having the knowledge of screen printing. According to the level of automation, the equipment varies from manual substrate feeding and squeegee operation, to a fully automatic press and mechanical handling of the substrate.

Equipment can be classified as manual (hand-operated), semiautomatic, and automatic. The relevance of these, account for the desire to incorporating screen-printing in the teaching of Fine and Applied Arts students in Federal College of Education (Technical), Asaba to enhance active participation and capacity building.

Statement of the Problem / Justification

The dwindling enrollment in Fine and Applied Arts Department at Federal Colleges of Education (Technical), Asaba can be traced to lack of access to contemporary teaching / learning equipment and tools needed for hands-on learning experiences. A good number of students graduate from the department lacking a practical knowledge of screen printing. Lack of suitable Screen-Printing Machine in the department has robed and still rubbing students access to equipment for practices in Graphic and Textile productions. This can hinder students' creative exploration and practical skills development. Hence, the pressing need to design and construct a Screen-Printing Machine in Fine and Applied Arts Department at Federal College of Education (Technical) Asaba.

Objectives of the Study

The main objective of this study is to fabricate a screen-printing machine that is suitable for Fine and Applied Arts students at Federal College of Education (Technical) Asaba. Specifically, the study aims at:

1. Designing a user friendly and educational screen-printing machine.
2. Identifying materials and tools required for fabrication within an academic setting.
3. Developing a cost - effective fabrication process suitable for student projects.
4. Evaluating the impact of using the fabricated screen-printing machine on students learning outcomes and practical skills.

1

2

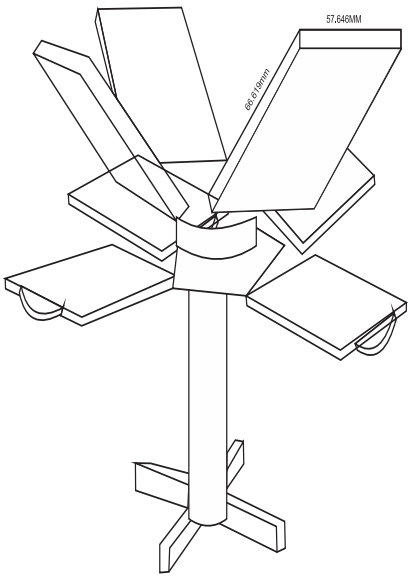

Fig: 1. Sample of Finished Screen-printing Machine **Fig: 2.**-3Dimensional rendering of sketch

METHODOLOGY

The under listed materials were combined to construct the Manual Screen-Printing Machine in conjunction with some services of Supporting Research Assistant/ craftsmen. The method includes construction / Fabrications. Several materials needed for the project were procured and processed to get the expected result.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume X Issue VII July 2026

Materials

1. Galvanized Pipe
2. Rectangular Mild Steel Pipe
3. Iron Plates in Circular, Square
4. Angle Iron
5. Bearing
6. Bolt Nut / Washer
7. Auto Base Paint / Thinner
8. White Hdf Ply board
9. Screws
10. Hinges

Source of Materials

The main sources of the materials used for the construction of the screen-printing machine were from the iron roll market in Asaba and Onitsha, while others where locally source from our immediate environment, Federal College of Education (Technical), Asaba.

The Frame Work

The frame work commenced with dimensions mapped out on 500mm rectangular mild steel pipe which is intended to be the base where other parts were welded in place and screwed for adjustment and compatibility with the design. The images here are the preview of the process.

3 **1**

Fig: 3 The Frame Work

Image: 1 The Galvanized Steel Pipe

This mild steel Galvanized Pipe as shown in image 4 is 500mm equivalent to 1ft 8 inches used to elevate the mechanism from the base to a working height and holds the mechanism in position for effective operation.

The **Angle Iron** shown in image 2 produced in four (4) pieces was used for construction of arms where the board was expected to rest for the printing mesh. It will be welded to the Iron plates in Circular Square and round used for the construction of the mechanism that will hold the mesh.

2 **3**

Image 2 Angle Iron **Image 3 Iron Plates in Circular**

Iron Plates in Circular, Square

The Iron plates in Circular Square and round in image 3 are made of iron. The iron plates are used for the construction of the rotating mechanism which was welded to the frame.

4 **5**

BEARINGS

Image 4: Bolt and Nuts **Image 5: Bearing**

Image 4 shows the bolt and Nut used to tighten the mesh to the rotating mechanism for printing and registration while Image 5 is the bearing used in the rotating process of the mechanism which helps to rotate the mesh round the four points of printing stations.

6

Figure 9 shows the white HDF Ply board, the printing base for the fabric. It was cut into four pieces and screwed to the angle irons meant to serve as the arms for the boards. The screws were used to hold the board to the printing space supported by the angle rod. The Hinges were used to hang the mesh holder with the mechanism to allow it to freely move up and dawn. Auto base paint and thinner are used to paint the finished work but left to dry for about 9 to 12 hours at the end of construction.

Bolts and Nuts

The entire frame of the Screen-Printing Machine is fixed into a unit with the use of various sizes of bolts and nuts. The size 24 bolt which is the biggest actually served to connect the main frame and provided the needed rigidity.

Finishing Spraying Coupling

After the material acquisition, component parts were produced first. The stand in round and the legs were cut to size and fixed, the rotating mechanism was produced, the holder (arm) holding the mesh was fabricated. The entire build is covered with auto-based paint. The metal frame was sprayed in grey and the other parts, nuts, hinges, bolts and bearing in black.

Assemblage

Screen printing is a popular technique in the growing field of Applied Art which is a significant aspect of the modern graphic and textile industry. The complete work of the design was put together in one peace in the following order: number 1 was connected to the next tagged number 2, then attached to number 3 in that sequence. The frame numbed 1, 2, 3, 4 and 5 were coupled together. Number 1 image is the support base joined to the legs which is expected to hold the whole pieces in place. The second frame of the piece which is the main body having the evolving mechanism was built up with numbers 3, 4, 5 and 6 welded together with the bolts going through for firmness and later attached to the base.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume X Issue VII July 2026

The angle iron was attached to the bearing used in the rotating process of the mechanism before the boards cut in sizes and required shape was attached with nuts. Number 8 and 9 shows all parts coupled, the final welding to the whole structure, complete construction. Then, test for stability alignment and painting with the auto paint.

The assemblage shows the one that comes first before the next in the order of progression. The group of images attached here are pictorials of the various parts of assemblage stage.

7 **8**

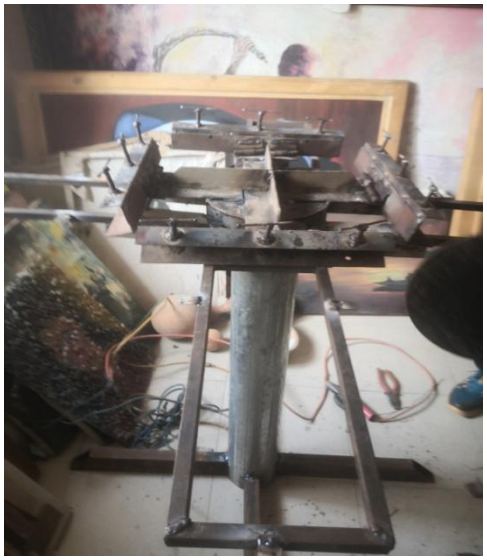

Image 7: White HDF Ply Board

9

Images 7, 8 and 9: Display of Skeletal versions of the machine

Complete Assemblage and Display

10

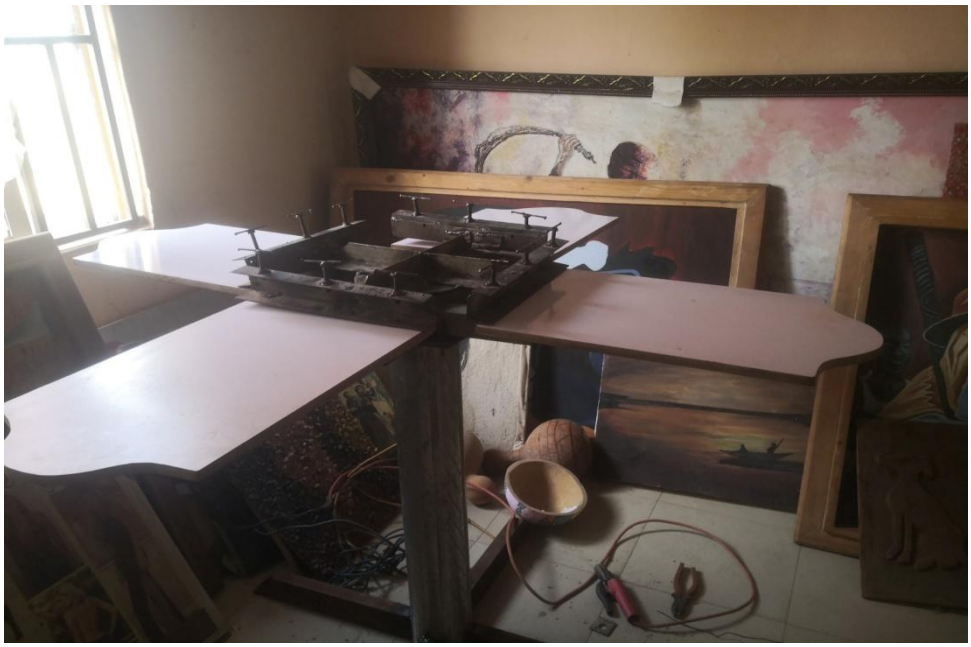

Image 10: Photo of all parts coupled

11

Image 11: Researchers pose with the Finished and Functional Screen-Printing Machine

This is the final assemble of the Manual Screen Printing Machine in functional state with a four-printing base, printing at the same time with four colours and a printer. Four colours such as Yellow, Magenta, Cyan and Black are needed to produce full-colour printing. This process enables the printer to attend to a four coloured work at the same time without calling for assistant.

CONCLUSIONS

We are aware there are auto mechanical screen-printing machine available across the continent but some artisan still find this very useful as it helps to quicken the production of their printing work as they find it very difficult to gather the resources needed to pay for a brand-new auto base screen printing machine following the state of Nigerian economy. The introduction of this machine to the Fine and Apply arts Department of the Federal College of Education (Technical) Asaba became very crucial as it was planned towards creating an alternative and indigenous machine to break the high cost of importing auto and contemporary screen-printing machine. Asides, this study has equally open up avenues for students to explore other options that are available and could afford necessary platform to achieving good results when it comes to printing works at minimal cost.

The fabrication and construction of screen-printing machine for students of Fine and Applied Arts Department in Federal College of Education (Technical), Asaba is great stride aimed at making teaching and learning of fine arts interesting, participatory and functional. It further reveals that a good number of machines needed for art works can be locally generated in the absence of foreign ones. In fact, it tends to raise the morale of students to be focused and consistently put in their best in academic endeavors. Several stages of the fabrication required the assemblage of local resources in terms of materials and personnel. Thus, it became clear that given better and right opportunities, scholars would attempt and procure machines and other art equipment needed for production of art works without relaying solely on foreign materials.

The study further created a level play ground for art students to demonstrate their various skills using available home made machines and materials.

RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER STUDIES

Recommendations

The following recommendations are hereby made:

Government should increase participation in practical research equipment and machine development in the department of Fine and Applied Arts, Federal College of Education (Technical) Asaba and other institutions across the country.

Staff and students of institutions of higher learning should be encouraged to go into creating tools that will enhance the easy achievement of their creative ideals in this era of AI Technology.

Tetfund should not relent in sponsoring more academic research in relevant areas in Vocational and Technical sub sector in the tertiary institutions in Nigeria by making fund available.

Suggestions for Further Studies

While the present study establishes the feasibility and process of locally fabricating a screen-printing machine for the Fine and Applied Arts Department, its scope was limited to documenting the construction process rather than evaluating the machine's downstream educational and practical impact. Building on this foundation, the following areas are recommended for further research.

Future studies should evaluate the educational impact of the constructed screen-printing machine through experimental or quasi-experimental designs, comparing learning outcomes, skill acquisition, and employability among students who use the equipment against those relying on traditional methods.

Detailed technical evaluations should be conducted to examine the machine's efficiency, durability, safety, maintenance needs, and cost-effectiveness under sustained classroom use, so as to substantiate its practical viability relative to imported alternatives.

Researchers should systematically collect feedback from students, instructors, and industry practitioners, with clearly reported sampling and data-collection procedures, to identify areas for improvement and ensure the machine meets both educational and professional requirements.

Similar studies could be extended to the development of other locally fabricated instructional tools for different areas of Fine and Applied Arts education, building a broader evidence base for indigenous technology adoption in vocational art education.

REFERENCES

1. Adeyeye, O. (2020). "Evaluation of Developments in Offset Lithography Printing Industry in South West Nigeria". (Ph.D. Seminar)
2. Baines, J. (2019). "A History of Screen Printing: Tracing Our Industry's Roots". Oxford: Oxford University Press.
3. Daniel, O. O., Haruna, A. A. & Atanu, B. U. (2009). "*Lithographic Plate and Serigraphic Mes Making Machine". p. 10, 12, 27*
4. Ifeanyi O. D, Ogunode N. J. & Ajape T. S. (2021). *Shortage of funds in the Nigerian Public Universities: Causes effects and ways forward. Innovative Technologica Methodical Research Journal*, 2 issue 7
5. Lastimosa, M. (2018). "Introduction to Screen-printing" (2018). Curricula. 30. Available at https://scholarworks.lib.csusb.edu/cap-curr/30.
6. Kipphan, H. (ED). (2001). *Handbook of print media technologies and production methods* (1st ed.). Berlin: Springer.
7. Komi, S. (2015) *Sakurai-Future screen printing applications*. http://www.natgraph.co.ukpdfs/Sakurai.
8. Luke, G. (2022). "*Research and Market Challenges for the Printing Industry". Global Industry Analysis Inc*, Guinness Centre Taylors Lane, Dublin 8, Ireland.
9. Sullivans, C. (2011), "History of screen printing." Curator JTPM.
10. Ukazu, I., 2022 "*Why fine art education is struggling and needs an overhaul"* Institute of Management and Technology (IMT), Enugu State.