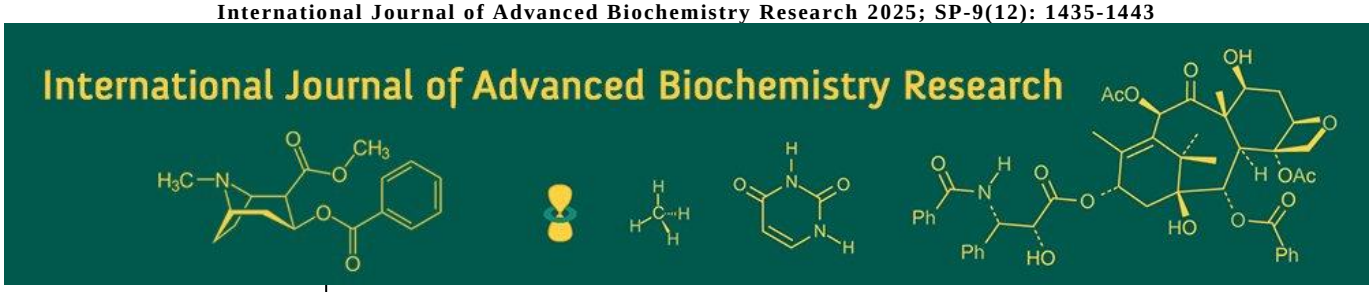

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Innovating traditional designs on apparel and home décor through fabric printing- preserving *Madhubani* essence

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Abstract
The traditional art of Madhubani from Bihar has been affected by social and economic changes, resulting in a decline in original compositions. Preserving this art form is important, and incorporating historic motifs into textiles, helps protect the designs. Contemporary designs draw inspiration from Indian folk arts, particularly painting. The present study focuses on adapting Madhubani motifs to create innovative designs inspired by the essence of Madhubani paintings. The study created forty designs using thirty-six motifs, selecting ten designs suitable for apparel and home décor products, utilizing CorelDraw software for intricate and appealing designs. Ten combinations of design, placements and colors were chosen for final development, and the study investigates on individuals' perspectives on Madhubani Painting adapted onto apparel and home décor items using block and screen printing techniques with cotton and silk fabrics and pigment dyes. Four products developed with screen-printing, and six with block printing techniques. The development of the apparel and home décor items involved the use of pigment dyes in colors such as red, green, sky blue, yellow, blue, magenta, brown and black, these pigment dyes evaluated according to colour- fastness tests carried out by several institutions, including assessments involving washing, light exposure, rubbing, and perspiration.
Based on expert preferences for the developed items, fabric-printing techniques deemed most favorable, particularly for their overall appearance. This approach opens new opportunities for women entrepreneurs to produce cost-effective items with high demand, while simultaneously enhancing the aesthetic beauty of traditional Madhubani painting.

Keywords: Adaptation, Block printing, Cotton and silk fabrics, Madhubani motifs, Pigment dyes, screen-printing

Introduction
Madhubani paintings, deeply rooted in Indian folk art, represent a classic form of Indian artistic expression with a distinct meaning and historical significance. India, renowned for its diverse cultural heritage, religious traditions, ethical values, and artistic expressions, possesses a wealth of artistic and create traditions. Indian arts and crafts hold immense potential in the global market, owing to their inherent aesthetic appeal and authenticity.
Traditionally, Madhubani painting involved intricate and time-consuming manual work, requiring great patience and skill. However, with the advent of technological advancements, this intricate art form can now be seamlessly transformed using computer-aided design (CAD) tools and transferred onto textiles through the convenience of digital printing. This integration of traditional artistry with modern techniques has opened new possibilities, for preserving and highlighting the beauty of Madhubani designs in a more efficient and precise manner.
Incorporating Madhubani painting themes into screen-printing and block printing techniques for clothing and home decor provides an opportunity for individuals seeking to infuse their traditions with a contemporary touch. This creative and captivating selection not only preserves the rich history of this art form but also expands the design possibilities for textile items, resulting in inventive utilization of traditional Madhubani motifs. By embracing traditional Madhubani motifs in innovative ways, a harmonious blend of cultural heritage

and modern aesthetics achieved, contributing to the preservation and evolution of this captivating art form.

Thus, keeping in view, the development of new and innovative designs derived from Madhubani motifs and their application on apparel and home decor items through a combination of screen-printing and block printing.

The study aimed to achieve the following objectives:

1. To explore the adaptation of Madhubani motifs for fabric printing.
2. To create designs utilizing selected motifs for fabric painting on apparel and home decor items.
3. To develop products incorporating the selected designs.

By undertaking this study, the study aimed to contribute to the advancement and utilization of Madhubani motifs in fabric printing, resulting in the producing unique and aesthetically appealing apparel and home decor items.

Methodology

Materials

Cotton and silk fabric

For this study, three different types of fabrics chosen: cotton, eri silk, and mulberry silk. These particular fabric kinds chosen in order to examine their compatibility and performance in connection to the study's goals (Table 1).

Pigment dyes

In the printing process, a range of pigment dyes employed in various colors. These colors included red, green, yellow, black, sky blue, orange, magenta, and brown.

Method

Documentation of motifs from Madhubani painting

For the current study, traditional motifs originating from Madhubani district of Bihar.Motif were collected from diverse primary and secondary sources. A total of fifty motifs were collected from primary and secondary sources, with consideration given to their compatibility for fabric painting. Out of the fifty motifs, thirty-six were deemed suitable for further analysis and utilization. The selected 36 motifs were utilized in the development of designs suitable for apparel and home décor items, utilizing the CorelDraw software. To ensure equal dye penetration, cotton and silk materials were prepared before printing. Desizing and degumming procedures were conducted following the standardized methods outlined by Karmakar (1999).

Development of designs for Apparel and Home Décor items

Four different placements of each design were generated using CorelDraw software. The selection of designs, their placements, and colors on the apparel and home décor items were based on the most preferred choices, employing the weighted mean score rank method. To facilitate this selection process, a preferential choice index was developed. A preference list for the created designs and their respective placement was obtained from the experts participating in the study. Their evaluations and feedback played a crucial role in determining the final selection of designs and placements for the apparel and home décor items. The local artisans of Madhubani, known for their expertise in the art form, were selected as the experts for this study. The rankings were assigned based on weighted mean scores provided by these artisans. Among the various designs and placements, the ten top-ranked designs and ten placements for each design were chosen for the creation of apparel and home décor items.Subsequently, the selected placements were utilized in the development of the products. Out of the ten products, four were developed using screen printing techniques, while the remaining six were created using block printing techniques.

Printing of selected apparel and home decor items

Utilizing pigment dyes with screen and block painting processes, the favored patterns were employed in the production of ten apparel and home décor articles. The Steamed painted objects underwent examination to assess colour fastness grades and to ensure proper dye absorption by the fibers. An interview schedule was developed to assess the respondent's preferences regarding painted apparel and home décor items. Participants were asked to specify their favored decorative motifs as well as the color schemes they preferred for the designed apparel and home décor products.

Colorfastness to washing.

Cotton and silk fabrics painted with pigment dyes had their colorfastness to washing tested using a launder meter in line with AATCC Method 36-1995.

Using six-step grey scales, the original painted samples' colour change and staining on nearby fabrics were each given a rating between 1-6, with a rating of 6 denoting extremely good fastness properties and a rating of 1 denoting extremely poor fastness properties.

Colorfastness to crocking and rubbing

The AATCC Method 8:1961 test was used to determine the colorfastness of all the painted samples against dry and wet crocking.

Colour fastness to pressing (dry and wet)

The AATCC Methods, 1962 test was used to evaluate the sample's responsiveness to pressing.

The dry and wet pressing samples were evaluated for colour change and colour staining using a standard grey scale.

Colour fastness to sunlight

The ASTM method's recommended test was used to determine how well-painted samples held their colour in direct sunlight. The test specimens' changes in colour with the ASTM Grey scale, the effect on their colour was evaluated.

Evaluation of developed designs

The developed designs and products underwent assessment based on their acceptability, utilizing the mental readiness of expert evaluators. These experts, consisting of faculty members and M.sc students from the Department of Textile and Apparel Designing of Home Science, were requested to provide their preferences on a five-point scale regarding the overall appearance, placement of design and colour of the products. Based on the weighted mean scores collected from the evaluations, ranks were given to the designs and products.

Result and Discussion

Adaptation and evaluation of design

The study encompassed Madhubani district as a comprehensive source for gathering information on traditional folk printing motifs**.** The results showed that four different types of Indian folk painting motifs floral, geometrical, animal, bird and religious were often used**.** Among these, Floral Motifs emerged as the most prevalent, followed by Animal and Birds Motifs, Religious Motifs, and Geometrical Motifs**.** "Furthermore, a meticulous process was undertaken to identify the thirty-six most frequently occurring motifs in Madhubani art, which were then selected for the development of final designs**.**

In order to produce ten distinct items, a total of forty designs were meticulously developed using Corel Drawsoftware**.** These designs were divided into four variations for each item, resulting in a comprehensive set of options**.** The design process involved the careful selection and adaptation of thirty-six motifs, resulting in forty unique design variations**.** Ultimately, ten designs were chosen from this collection to be implemented in the production of apparel and home décor items**.**

The expert evaluation revealed that design number 3 (WMS 4.03), design number 5 (WMS 4.00), design number 10 (WMS 4.30), design number 13 (WMS 4.26), design number 19 (WMS 3.63), design number 21 (WMS 3.87), design number 27 (WMS 3.83), design number 30 (WMS 4.13), design number 34 (WMS 3.93), and design number 39 (WMS 3.77)received the highest preference for ten different items including bedsheet, Table mat 1, Stoles 1, Wall hanging, Kurti, Trouser, Top, Mask, Stole 2 and Table mat 2.

These ten precisely selected traditional designs were chosen for their adaptation into fabric painting, as depicted in Figure 1."

Preparation of products

The bedsheet measuring 60″ x90″was influenced by Madhubani painting. A representation of human motifs with religious patterns were incorporated into the border of the bedcover through the utilization of screen-printing techniques. Various colors, including black, red, and green, have been employed on cotton fabric for this purpose (Fig.3).

The table mat, measuring 12 inches by 18 inches, was inspired by Madhubani painting. Stylized peacock motifs have been incorporated into the center and border of the table mat using. Sky blue color has been applied on cotton fabric for this purpose (Fig.5).

The design of Stoles 1 draws inspiration from Madhubani painting, specifically incorporating fish motifs into the border. The stoles were finished using black, red, and yellow colors (Fig.10).

The wall hanging, measuring 9 inches by 9 inches, was inspired by Madhubani painting. It features animal motifs with floral designs incorporated in the center of the wall hanging using screen printing techniques. The colors used for this design include black, brown, green, and red (Fig.13).

The standardized measurement of the Kurti was taken. A floral design with a geometric pattern was incorporated into the neckline of the Kurti using block printing techniques. The design was created using various colors, including magenta and black (Fig.19).

The standardized measurements of the trouser were taken. A floral design was incorporated into the border of the trouser using block printing techniques. The design employed various colors, including red and green (Fig.21).

The standardized measurements of the top were taken. An Animal motif with religious motifs were incorporated into the border using block printing techniques. The design utilized various colors, such as yellow and sky blue (Fig.27).

The mask draws inspiration from Madhubani painting, featuring a floral design in the center created through block printing in black color (Fig.30).

Stole 2 takes inspiration from Madhubani painting, incorporating a fish motif with a floral design in the center of the stole. Block printing techniques were used, employing different colors such as magenta and green (Fig.34).

Table mat 2 draws inspiration from Madhubani painting, with a floral motif adapted into the border of the stole using block printing techniques in green color (Fig.39).

Ten traditional designs were meticulously printed onto fabric using precise techniques, as illustrated in Figure 2.

Assessment of Developed Products

The assessment of the developed apparels and home décor items involved a thorough evaluation based on design placement, overall appearance, and cost analysis. Décor items. The products were made using Corel Draw software, which adapted a total of tendesigns virtual placements for different items. Based on the expert preferences discovered using a five (5) preferential index. According to the adopted preferential index, the following design were selected: overall, color,placement of design number 10 (WMS 4.33)was ranked first followed bydesign number 13 (WMS 4.17), design number 5 (WMS 4.03) and design number 3 (WMS 3.93)ranked second, third, and fourth.

Placement of design number 30 (WMS 4.00) was ranked first followed bydesign number 34 (WMS 3.97) and design number 39 (WMS 3.77), design number 21 (WMS 3.67), design number 27 (WMS 3.63) and design number 19 (WMS 3.57) ranking second, third, fourth, fifth, and sixth in block printing.

Colour of design number 3 (WMS 4.06)was ranked first followed bydesign number 13 (WMS 4.03), design number 10 (WMS 3.93) and design number 5 (WMS 3.90)ranked second, third, and fourth.Colour of design number 30 (WMS 4.17)was ranked first followed by design number 21 (WMS 3.63), design number 34 (WMS 3.63), design number 39 (WMS 3.77), design number 19 (WMS 3.53) and design number 27 (WMS 3.50) ranking second, third, fourth, fifth, and sixth.

In terms of overall appearance, Design no**.** 10 was ranked first followed by Design no**.** 13, Design no**.** 3, and Design no**.** 5, ranked second, third, and fourth in screen-printing**.** Design no**.** 30 was ranked first followed by Design no**.** 34, Design no**.** 21, Design no**.** 27, Design no**.** 39, and Design no**.** 19 ranking second, third, fourth, fifth, and sixth in block printing**.** Both types of developed items were taken into consideration, and the most aesthetically acceptable evolved design and overall appearance were chosen. It shows that the overall appearance, placement and colour of design in printing techniques was more aesthetically appealing (Table 2).

The cost of developing final products was calculated as the sum of the costs of raw materials used, including the price of the fabric, the expenses of sewing, printing, building

screens and blocks, and the labor cost. At a rate of 200 rupees per day for skilled workers, the labour cost was calculated by the number of preparation hours put into a product during printing. The total cost of screen-printed items with Design no. 3, Design no. 5, Design no. 10, and Design no. 13 was ₹520/-, ₹435/-, ₹1425/-, and ₹380/-, respectively. The total cost of block-printed items with Design no. 19, Design no. 21, Design no. 27, Design no. 30, Design no. 34, and Design no. 39 was ₹746/-, ₹725/-, ₹725/-, ₹60/-, ₹1460/-, and ₹425/-, respectively. The results of study would be beneficial for women entrepreneurship and in maintaining the beauty of traditional design.

Assessment of fastness to washing

The data regarding washing fastness indicated that the printed samples showed different levels of performance. In terms of cotton fabric, it exhibited good washing fastness with a rating of 5 in color change and only a slight change in staining, rated 4. The silk fabric, on the other hand, had excellent washing fastness, scoring a 5 for colour change and a similar score for a negligible or no staining (Table 3).

Assessment of fastness to Crocking and Rubbing

The results highlighted the performance of Crocking and Rubbing fastness under different conditions. In dry conditions, the cotton fabric exhibited good color change resistance and negligible or no staining, scoring a rating of five in both aspects. However, in wet conditions, the cotton fabric showed a lower level of performance with a rating of very fair (4) in color change and noticeable staining (3) in the change of staining.

On the other hand the silk fabric, performed exceptionally well in dry conditions, earning a very good rating of (6) for colour change resistance and little to no staining in the change of staining. Similar to dry conditions, the silk fabric demonstrated good colour change resistance and minimal staining during the staining transition.

Washing fastness grades

The color fastness grades to washing of cotton and silk printed samples using various pigment dyes were documented in Table 2. The results showed that both cotton and silk textiles' washing fastness ratings for printed samples, regarding colour change, were graded as good (5). Additionally, the cotton fabric displayed a slight change in staining, while the silk fabric exhibited either negligible or no staining in the change of staining.

Assessment of fastness to Pressing fastness

The results of color fastness testing for printed samples under different conditions are as follows*:* In dry conditions, the cotton fabric demonstrated very in change of colour and negligible or no staining in change in stained. Conversely, in wet conditions, the cotton fabric showed very good in change of colour and slightly stained in change in stained. Similarly, in dry conditions, the silk fabric displayed good in change of colour and negligible or no staining in change in stained. In wet conditions, the silk fabric showed good in change of colour and slightly stained in change in stained.

Assessment of fastness to Sunlight fastness

Both cotton fabric and silk fabric demonstrated very good colorfastness in terms of colour change. Hence, the results indicate that the sunlight fastness of pigment dyes was rated as very good to excellent for both fabric types.

1. Cotton and silk fabric

Table 1: Description of the fabrics

Sl.no	Fabric	Count (Yarn/ Inch)		Thickness(mm)	Weight(g/inch)	Tearing Strength(g)
		Warp	Weft			
1.	Cotton	60	52	21	0.60	51.9
2.	Mulberry silk	63	42	10	0.47	39.6
3.	Eri silk	34	22	43	43.0	76.8

2. Assessment of Developedproducts

Table 2: Assessment of the developed products as per appeal level of the developed design and overall appearance (n= 30)

Screen Printing	Overall appearance		placement of design		Colour of design	
	WMS	Ranks	WMS	Ranks	WMS	Ranks
Design no 3	4.03	III	3.93	IV	4.06	I
Design no 5	4.00	IV	4.03	III	3.90	IV
Design no 10	4.30	I	4.33	I	3.93	III
Design no 13	4.26	II	4.17	II	4.03	II
Block printing						
Design no 19	3.63	VI	3.57	VI	3.53	V
Design no 21	3.87	III	3.67	IV	3.63	IV
Design no 27	3.83	IV	3.63	V	3.50	VI
Design no 30	4.13	I	4.00	I	4.17	I
Design no 34	3.93	II	3.97	II	3.63	III
Design no 39	3.77	V	3.77	III	3.77	II

WMS- Weighted mean score

3. Washing fastness grades

Table 3: Colour fastness properties of samples

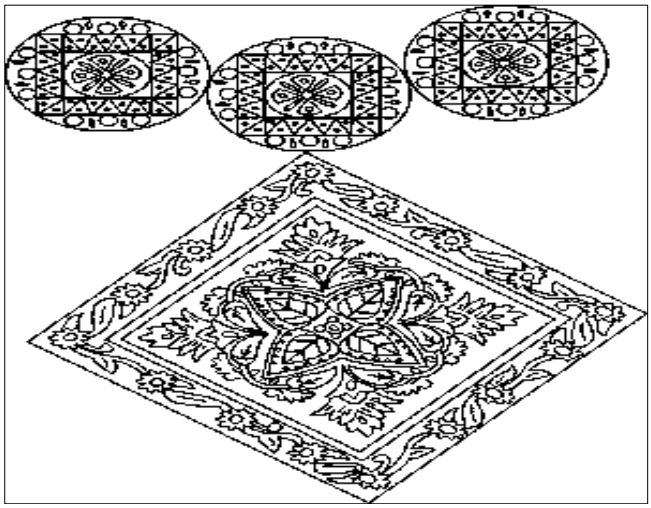
Fabric	Washing fastness grades		Crocking and Rubbing fastness grades				Pressing fastness grades				Sunlight fastness grades
			Dry		Wet		Dry		Wet		
	CC	CS	CC	CS	CC	CS	CC	CS	CC	CS	CC
Cotton	5	4	5	5	4	3	6	5	6	4	6
Silk	5	5	6	5	5	4	5	5	5	4	6

Note*:* CC*:* Color change, CS*:* Color staining

1. Design number 3

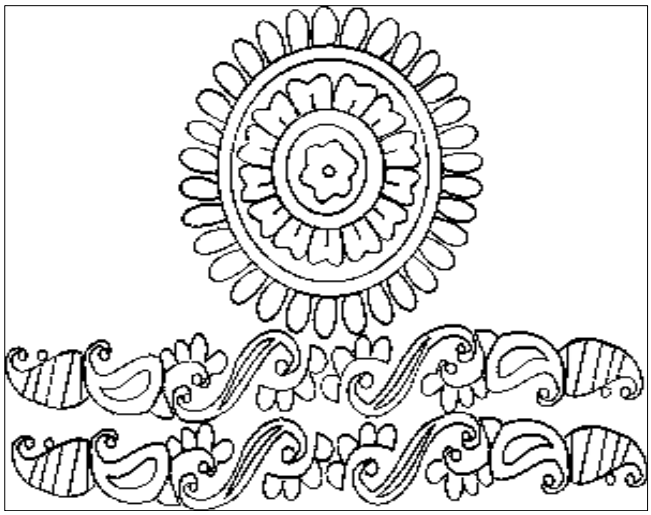
4. Design number 13

2. Design number 5

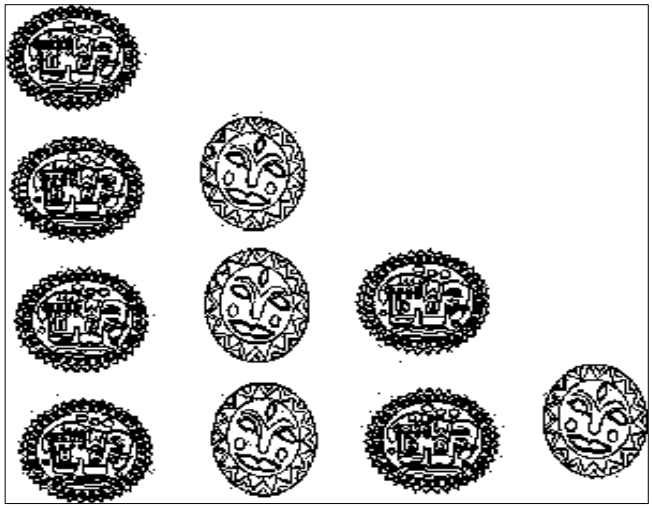


5. Design number 19

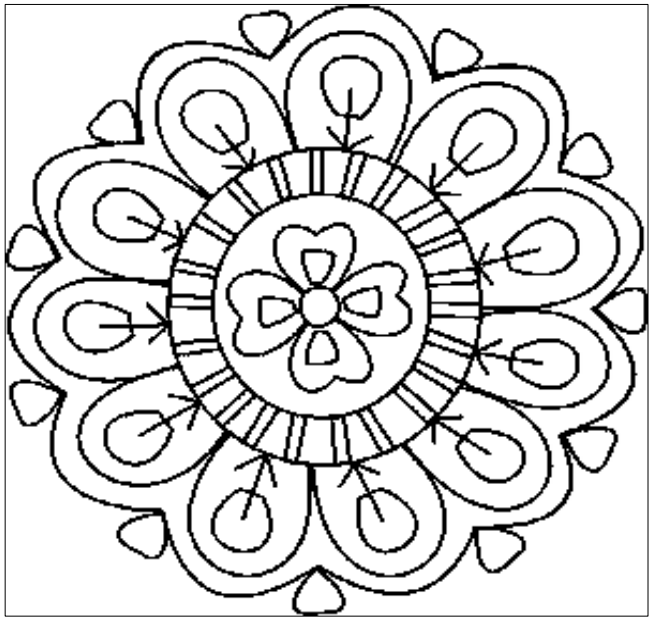
3. Design number 10



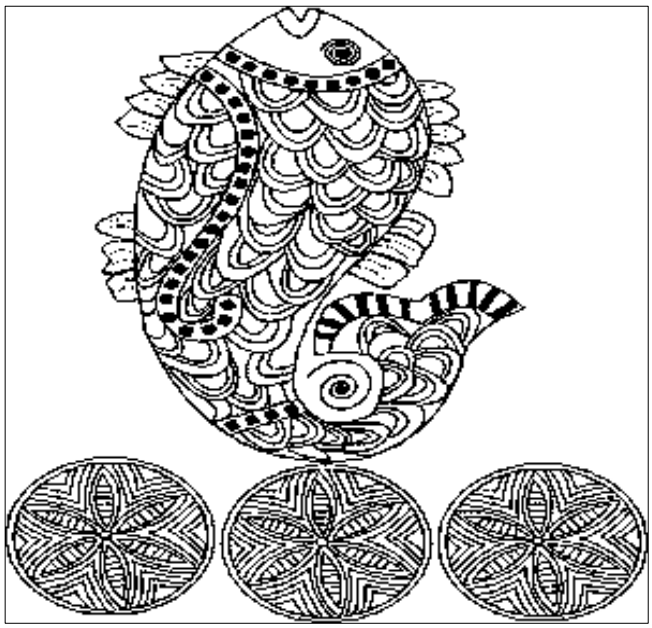
6. Design number 21



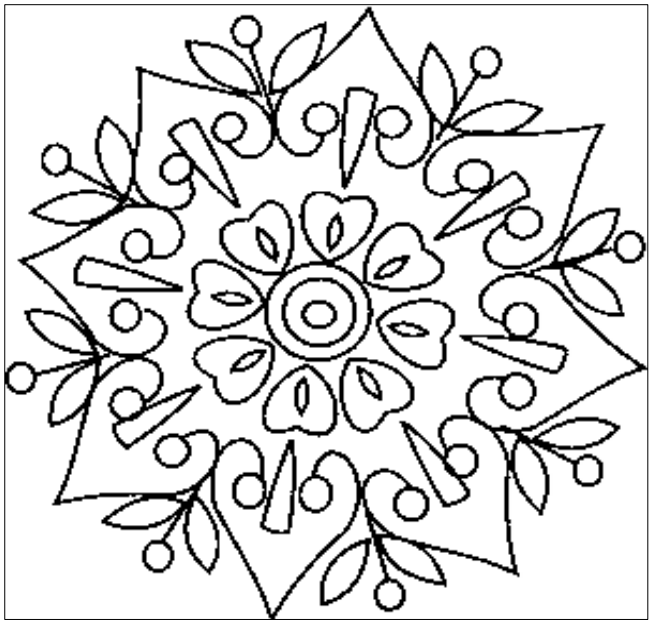
7. Design number 27



8. Design number 30



9. Design number 34



10. Design number 39

Fig 1: Selected printing design for adaptation into fabric painting according to preference

1. Design no 3

2. Design no 5

3. Design no 10

4. Design no 13

5. Design no 19

6. Design no 21

7. Design no 27

8. Design no 30

9. Design no 34

10. Design no 39

Fig 2: Printedapparel and home décor items with screen and block printing

Conclusion

Bihar is proud of its long history of inventiveness and resourcefulness, which was reflected in its rich tradition of folk art and craft**.** The practice of painting in the Madhubani or Mithila style is prevalent in the Terai region of Nepal and the Mithila region of Bihar, India**.** Over generations, skilled artists have contributed to the creation of the renowned Madhubani paintings, which have become one of the most renowned art forms from Bihar**.** These paintings are created using a method that is generally simple**.** Madhubani paintings feature a variety of natural elements such as peacocks, fish, flowers, birds, animals, and other forms of wildlife**.** These paintings also incorporate curving linear motifs, sequences of circles, and series of small lines**.** Consequently, the present study aimed to transform these traditional designs into fabric printing for apparel and home décor items**.** The focus was on adapting Indian painting motifs for fabric printing, with Madhubani painting and its motifs being chosen as the primary and secondary inspiration**.** A total of forty stylized designs were developed, integrating the selected motifs, and using CorelDrawsoftware, four potential placements were created for each design**.**

To assess the preferences of experts regarding the developed designs, their colors, and their placement on apparel and home décor items, a preferential index was created**.** Ten designs were carefully chosen by experts to be applied to different products**.**

For each selected design, experts determined the most favorable, which was then transformed into Madhubani paintings and replicated using fabric painting techniques**.** As the outcome, ten apparel and home décor items were manufactured, four of which were screen-printed and six of which were block printed**.**

Based on the expert preferences for the developed apparel and home décor items across various parameters, fabric-printing techniques emerged as the most preferred approach, primarily due to the superior overall appearance achieved**.** Notably, both cotton and silk fabrics demonstrated good colorfastness when subjected to washing, rubbing, pressing, and exposure to sunlight**.** Regarding pricing, the majority of respondents considered the prices to be fair for all clothing items, while only a small minority believed the prices to be either too low or too high for the manufactured items**.**

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