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Adaptation of Warli art on Apparels through CAD by using Heat Transfer Printing Technique

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Abstract:

India boasts a rich and diverse tradition. Its textiles feature a wide array of unique designs and are renowned for their distinctive and unmatched motifs. Every area in India showcases its own unique style and pattern of art, commonly referred to as folk art. One of the most recognized forms of Indian folk paintings is Warli art, originating from the state of Maharashtra. Traditionally, these Warli paintings were created by hand, which involves a labor-intensive and time-consuming process. However, with the passage of time and the availability of various printing methods, these artworks can now be printed on fabric using different techniques. This study aims to create a Warli painting from Maharashtra suitable for printing on clothing products. A total of thirty designs were created using software like Adobe Photoshop and Corel Draw, with ten designs each for apparel, including kurtis, suits, and sarees. All the designs were visually evaluated by a panel of thirty judges to select the top two designs from each category. The chosen designs were then applied to the apparel using a heat transfer printing method. The cost of each item was determined by calculating expenses related to raw materials, labor, finishing, and profit margin.

Key words: Warli, Printing, Designs, Art, Heat transfer, Traditional Painting.

1. Introduction:

India's textile heritage is a sophisticated legacy that has been carefully maintained over thousands of years. The remarkable diversity of Indian textiles showcases the country's cultural depth and flexibility, highlighting the ingenuity of Indian artisans through their vibrant patterns and creative motifs. Throughout the years, textile designers in India have produced countless designs inspired by various elements. However, designs featuring the beauty of Indian monuments are quite uncommon (Pandey, R., et.al., 2022).

Printing can be defined as the technique of applying pressure in a certain quantity of colouring agent onto a specified surface to form body of text or an illustration. (Lechene, 2025).

The process of printing entails copying and transferring text and images onto a variety of materials, such as fabric, metal, glass, and paper. Printing has a long history, dating from the first woodblock printing in China to Johannes Gutenberg's ground-breaking moveable type press in the fifteenth century. Printing is still a key industry that supports many other industries by producing necessary products like books, newspapers, packaging, and labels, even if the digital age has changed how information is disseminated. Offset lithography, gravure,flexography, screen printing, inkjet, and 3D printing are the primary printing techniques; each is appropriate for a variety of uses and sizes. Dewey, Joseph, (2024)

The folk paintings from India are characterized by vibrant designs that often feature religious and mystical themes. Among the best-known folk-art styles in India are the Patachitra painting from Orissa, Nirmal painting from Andhra Pradesh, Madhubani painting from Bihar, and Warli painting from Maharashtra (Gupta and Gangwar 2016).

The term "Warli" originates from the word *warla*, which translates to ‘piece of land’. Warli paintings are a traditional art form from Maharashtra. This ancient style of Indian artwork can be traced back to the Neolithic era. Warli painting is a well-known type of tribal art. The artistry of Warli vividly showcases the talents of local craftsmen and the rich cultural heritage of the region. Warli is a restricted art tediously made on walls by artisans using painting techniques. The designs are very interesting and can be used on textile products with modification. The integration of the Warli motifs on textile materials using heat transfer print can be executed in a very short time with precision, the motifs can be arranged and replicated to produce beautiful decorative designs that would help in confirming rhythm in designs (Vedika, 2014).

Heat transfer printing is the process of transferring of design into a special transfer paper layer. It is also non-as thermal printing or sublimation printing is the process where designs, pattern or images are transferred from a special heat transfer paper onto a substrate through the application of heat and pressure told by (Jayalakshimi and Sridevi 2024).

Adaptation is the process of adapting something to a situation (Anonymous, 20225). The advancement of the textile industry through the adoption of fast design processes and diverse color combinations using Computer-Aided Design (CAD) enhances the industry's competitiveness to adapt to the swiftly evolving preferences of consumers. The implementation of CAD has not only facilitated the creation of innovative and intricate designs but has also shortened the overall time involved in the process. CAD enables designers to preview textile designs before production and allows for the generation of new color combinations with just a click of the mouse. It has truly enhanced flexibility and minimized the time required to bring new designs to life. (Kishore, 2018).

The current research aimed to integrate these design aspects into textile design using CAD software. By applying Warli art to textiles with CAD software, it can meet the needs of contemporary consumers seeking innovation.

2. Objectives:

- To create digital adaptations of Warli art using CAD software on Apparel category.
- To apply the Heat Transfer printing technique for transferring Warli art design onto fabric.

3. Methodology

Adaptation of Warli motifs for design development of product:

This phase includes creation of designs through adaptation of Warli art motifs using CAD selection of created designs, design placements and colour ways.

The experimental work has been presented under the following heads:

3.1 Selection of Traditional Painting on cotton fabric.

3.2 Selection of Warli Motifs

3.3 Adaption CAD

3.4 Development of Design Arrangement and their Selection

3.5 Development of Colour Combination with Warli Motif

3.6 Evaluation of Developed Product

3.1 Appropriate motifs were selected and modified to create new designs for different clothing items. The layouts of the motifs were arranged using "Corel Draw" and "Adobe Photoshop." Sublimation printing was used for making articles. The cost of each product was calculated based on raw material cost (fabric, printing, etc.), labour charge and finishing cost. The sale price was calculated by adding 25 per cent profit margin in the cost price. A total of thirty designs were created for apparel, with ten designs each for sarees, suits, and kurties.

3.2 Screening of the developed designs through visual evaluation:

The prepared designs underwent a visual assessment to identify the two most preferred designs from each apparel category. A panel consisting of thirty judges conducted the evaluation. All designs were ranked based on the preferences expressed. The evaluation criteria for the designs included the arrangement of motifs, suitability of designs, colour combinations, and the overall visual appeal.

3.3 Acceptability of the prepared product:

Each prepared apparel article was evaluated to determine the acceptability of the products. The same group of 30 judges were used for the evaluation. A ranking form was provided to the check the acceptability of the developed products. The criteria evaluated included colour combination, appropriateness of design for the final products, price range, suitability of the surface embellishment techniques used, and overall appearance. Ranks 1, 2, 3, 4, and 5 were assigned to the products, representing poor, fair, good, very good, and excellent, respectively.

3.4 Result and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads:

3.5 Developed designs:

The designs prepared for various apparel articles are shown in Plate 1 – 8.

3.6 scores obtained based on visual evaluation:

The scores for each design of kurties, suits, and sarees are illustrated in Figures 1, 2, and 3, respectively. It was found that for the kurties designs, K9 achieved the highest score (4.75) while K8 followed with (4.45). For the designs of ladies' suits, D2 received the top scorer (4.54), closely followed by D7 (4.49). Among the saree designs, S8 obtained the highest score (4.57), with S5 coming in second (4.45). Therefore, all these designs were produced using heat transfer printing.

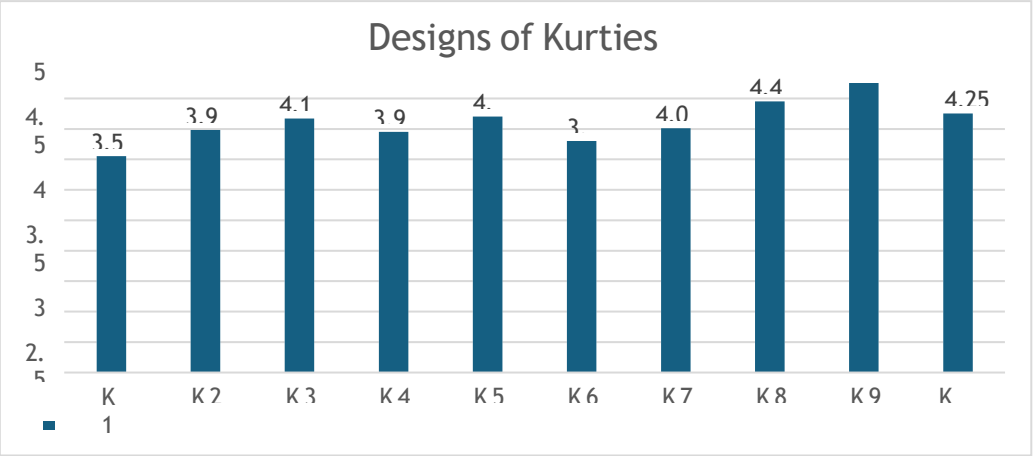

Fig. 1: Scores obtained for developed designs of *kurties*

Cost of prepared articles:

The cost of prepared products is given in Table 1 to 3.

Kurti I Kurti II (Spiral motif) Table 1: Cost of printed Kurties

S.No.	Particulars	Kurti I			Kurti II		
		Consumption	Price (Rs.)	Value (Rs.)	Consumption	Price (Rs.)	Value (Rs.)
1	Cut length of Cotton fabric	2.5 meter	300/ meter	750	2.5 meter	300/meter	750/-
2	Cut length of Cotton fabric for lining	-	-		-	-	-
3	Printing charges	2.5 meter		300	2.5 meter		300
4	Cost of trims	7 buttons	2*button	14/-	2 buttons	4*button	8/-
5	Stitching charges		200	200		200	200
	Actual cost			1250			1258
	25% profit			313			315
	Sales price			1577			1573

Table indicates that the cost of printed Kurti I was slightly higher (Rs.1577) than Kurti II (Rs.1573) due to the more consumption of button.

Suit I (Shehnai Warli motif)

Suit II (Drum motif)

Table 2: Cost of printed suits

S.No.	Particular	Suit I				Suit II		
		Consumption	**Price (Rs.)**	**Value (Rs.)**		**Consumption**	**Price (Rs.)**	**Value (Rs.)**
1	Cut length of fabric	2.5 m	150/meter	375		2.5 m	150/meter	375
2	Stitching charges	1	200/article	200		1	200/article	200
3	Printing Cost	2.5	**300**	**300**		2.5	**300**	**300**
	Actual Cost			**875**				**875**
	25% profit			**219**				**219**
	Sale profit			**1094**				**1094**

The above table no.2 clearly indicates that the cost of printed suit II was same (Rs1094.) than the suit I (Rs. 1094). So, products can be considered.

Saree I Tribal Motif

Saree II Peacock & Brick Motif

Table 3: Cost of printed sarees

S.No.	Particular	Saree I				Saree II		
		Consumption	**Price (Rs.)**	**Value (Rs.)**		**Consumption**	**Price (Rs.)**	**Value (Rs.)**
1	Cut length of fabric	6.5 m	350/meter	2275		6.5 m	350/meter	2275

2	Stitching charges with fall	1	500/article	500		1	500/article	500
3	Linning	1 m	60	60		1 m	60	60
4	Printing Cost	2.5	**300**	**300**		2.5	**500**	**500**
	Actual Cost			**3135**				**3335**
	25% profit			**784**				**834**
	Sale profit			**3919**				**4169**

The above table no.3 indicates that the cost of printed saree II was higher (4169) than the saree I (Rs.3919). The main reason was the difference in cost of printing saree II was higher than the cost of printing saree I.

Table 4: Acceptability of the developed apparel items

Product s	Article s	Suitabilit y of surface enrichme nt technique	Color combinatio n	Neatnes s	Cos t	Overall appearan ce	Acceptab le score	Ran k
Kurties	I	4.2	4.3	4.4	4.1	4.2	4.24	II
Suits	II	4.4	4.5	4.5	4.2	4.6	4.44	I
Sarees	I	4.1	4.2	4.6	4.1	4.2	4.24	II
Sarees	II	4.0	4.4	4.5	4.6	4.7	4.44	I

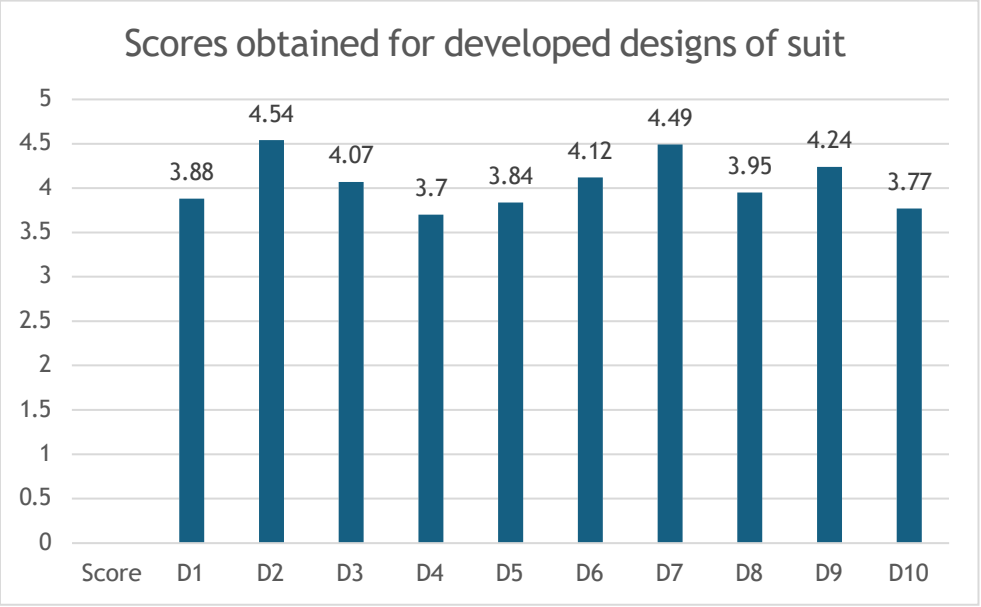

Fig.2 scores obtained for developed designs of suit

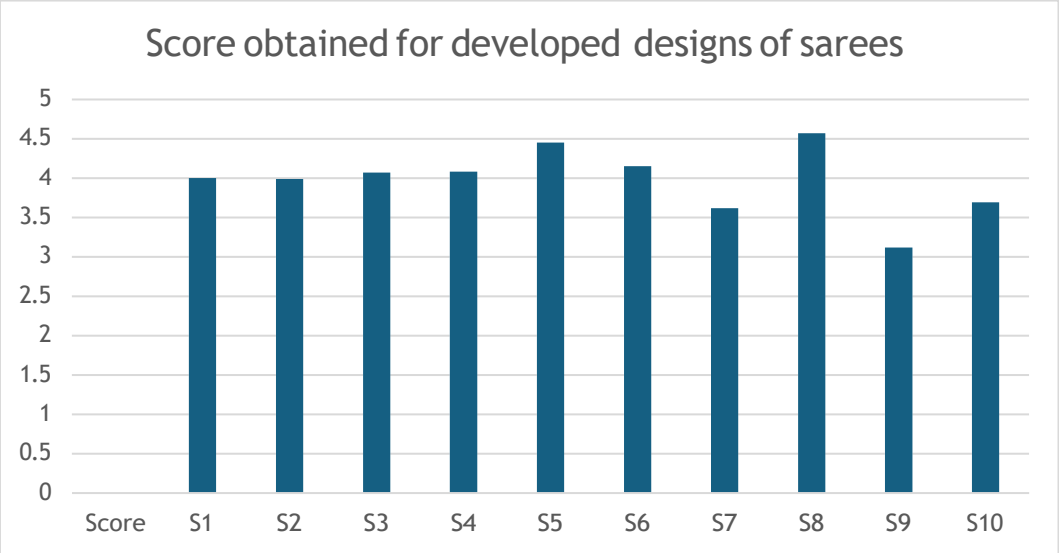

Fig. 3: Scores obtained for developed design of sarees

For assessment of acceptability and the results are reported in Table 1, 2, 3 and 4. It was observed that irrespective of higher cost, Kurti I was given 1st preference due to its colour combination. Among the prepared suits similar results were obtained. Suit II was given 1st preference with total score of 4.38 while suit I was scored second.

In case of prepared saree II was liked by most of the judges and it scored higher marks than saree I. Arrangement of motif, color combination and less cost value were the main reasons for giving it 1st preference. Though all the prepared products were highly appreciated and accepted but Kurti I, Suit II and Saree II were given higher marks.

Conclusion:

The Warli motifs were successfully adapted for designing apparel articles using Heat transfer printing. All the prepared products were highly appreciated and well accepted with regards to visual evaluation and cost effectiveness.

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