



# Designing Visual Communication Strategies For Plant Dyeing Crafts: Enhancing Public Engagement And Cognition

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## ABSTRACT

As society increasingly focuses on sustainable development and traditional crafts, the environmentally friendly and health-conscious craft of plant dyeing has gained attention from the public as well as the fashion and academic sectors. However, despite wide recognition of its environmental and cultural value, public awareness and engagement with plant dyeing techniques remain relatively limited. This study aims to explore how visual communication design can enhance public awareness and participation in plant dyeing crafts. Utilizing a mixed-methods approach that combines quantitative surveys and qualitative interviews, a series of visual communication tools were evaluated: infographics and fashion show designs, all intended to enhance public understanding of plant dyeing crafts. Results indicate that innovative designs that combine narrative storytelling, step-by-step visualization, and creative fashion elements significantly increase audience interest and engagement. This study not only provides effective communication strategies for the education and promotion of plant dyeing crafts but also offers valuable insights into the modern dissemination of other traditional crafts.

**Keywords:** Plant Dyeing Crafts, Visual Communication, Design Strategies, Educational Outreach

## 1. Introduction

In 2006, the Bai ethnic group's tie-dyeing was included in the national list for the protection of intangible cultural heritage by the Ministry of Culture. With the establishment of the consciousness of "Chinese cultural confidence," the protection and inheritance of intangible cultural heritage have become particularly urgent (Xin, 2011). However, despite the recognized value and cultural significance of plant dyeing crafts, public awareness and participation remain limited. This limitation primarily stems from insufficient dissemination of information on plant dyeing and a lack of understanding. Therefore, this study raises a crucial research question: How can visual communication design be effectively utilized to enhance public awareness and participation in plant dyeing crafts? By exploring this question, this paper aims to reveal the potential of visual communication in promoting education and dissemination of plant dyeing crafts, offering new strategies and perspectives for the modern communication of traditional skills.

The application of visual infographics in the dissemination is used in the conveyance of information, education, and design among many fields, with the primary goal being to enhance the understandability, appeal, and memorability of information through visual elements (Lankow et al., 2012). By transforming complex concepts, processes, and categories of plant dyeing into intuitive visual symbols, the information becomes more accessible and absorbable by the general audience.

Furthermore, fashion show designs serve as visual communication tools that convey the craft characteristics, cultural values, and brand philosophies (Aly, 2015). Through visual languages such as color, silhouette, and material, they communicate the sustainable innovative design concept of plant dyeing crafts, promoting the cultural history and value of plant dyeing (Varadarajan & Venkatachalam, 2016).

Thus, in a modern society dominated by fast consumption and industrialized production, the visual communication strategy of plant dyeing crafts is not only an exploration and protection of traditional culture but also a practice of the concept of sustainable development.

Hence, this study is primarily focused on evaluating the role of visual communication design in the educational dissemination of plant dyeing techniques (Worth, 2016). Firstly, it assesses the effectiveness of various visual design methods, such as infographics and fashion show designs, in enhancing public awareness, participation, and interest. This evaluation seeks to determine how effectively these visual tools can engage audiences and increase their understanding and appreciation of plant dyeing crafts. Secondly, the research explores best practices in visual communication design. Drawing on the initial findings, it discusses strategies and practices that are most effective in visual communication, aiming to maximize their potential in both educating about and promoting plant dyeing crafts. Lastly, the study proposes how visual communication design can contribute to the sustainability and cultural heritage preservation of traditional crafts (Härkönen et al., 2018). It offers strategic insights into how these design methods can be employed to promote the sustainable development and cultural heritage of plant dyeing techniques, thus aiding in the protection and promotion of traditional crafts. Each of these aims contributes to a comprehensive understanding of the intersection between visual communication design and traditional craft education, providing a basis for further research and practical applications in the field.

## 2. Literature Review

The visual communication of traditional crafts is a complex and multifaceted field, as evidenced by a range of studies. Bingying (2023) and Ke (2021) both explore the application of traditional Chinese arts and crafts in visual communication design, with Peng emphasizing the importance of preserving traditional culture. Song (2023) takes a more technical approach, developing a visualization system for traditional crafts using text mining and sentiment analysis. Liu (2021) discussed the integration of Hubei traditional crafts and visual communication design education. These studies collectively highlight the rich potential for visual communication to both preserve and innovate traditional crafts.

In Richard E. Mayer's "The Cambridge Handbook of Multimedia Learning", there is a comprehensive exploration of cognitive theories relevant to multimedia learning, foundational principles of multimedia design, and practical guidelines for creating impactful multimedia materials. Mayer delves into cognitive theories that explain how people process information presented through different media formats. This includes the cognitive theory of multimedia learning, which emphasizes the importance of managing cognitive load and leveraging dualchannels (auditory and visual) for effective learning (Mayer, 2005) (Mayer & Moreno, 1998).

While visual communication and artistic education methods are significantly effective in enhancing public knowledge absorption and engagement, existing research seldom explores how these methods are applied in the dissemination of traditional crafts (Yeo, 2014), especially in the context of plant dyeing crafts. As an art form with dual value in technology and culture, plant dyeing has unique demands for visual communication. Yet, there is a paucity of in-depth discussion on related strategies and practices. Therefore, this paper aims to bridge this research gap by investigating the application and effectiveness of visual communication design in the education and promotion of plant dyeing crafts.

Therefore, this research constructs a conceptual framework, as shown in figure 1.



Figure 1. Research framework

## 3. Research Methodology

This study used a mixed approach (Timans et al., 2019) to comprehensively evaluate visual design strategies by combining quantitative and qualitative research on Target Audience and Effectiveness Assessments. Two

main visual communication design methods were chosen: visual information graphics and fashion show design (Richey & Klein, 2014).

Name	Option	Frequency	Percentage (%)
Gender	Male	167	52.19
	Female	153	47.81
Age	Under 18 years old	19	5.94
	18-24 years old	39	12.19
	25-34 years old	159	49.69
	35-44 years old	25	7.81
	45-60 years old	44	13.75
	Over 60 years old	34	10.63
	0 - 50,000 yuan	29	9.06
Income Range	50,001 - 100,000 yuan	67	20.94
	100,001 - 400,000 yuan	183	57.19
	400,001 - 1,000,000 yuan	41	12.81
Educational Background	High School and Below	41	12.81
	Bachelor's Degree	88	27.50
	Master's Degree	162	50.63
	Doctoral Degree	29	9.06
Understanding of Plant Dyeing	No Understanding	69	21.56
	Lack of Understanding	100	31.25
	General Understanding	69	21.56
	In-depth Understanding	82	25.62
Frequency of Purchasing Plant Dye Products	Never	56	17.50
	Once in My Lifetime (Rarely)	55	17.19
	Twice (Occasionally)	56	17.50
	Once a Year (Usually)	96	30.00
	More than Once a Year (Always)	57	17.81

**Table 1:** Demographic Variable Analysis

Based on Table 1, analyzing the demographic variables of 306 respondents, the data includes "Gender," "Age," "Income Range," "Educational Background," "Understanding of Plant Dyeing," and "Frequency of Purchasing Plant Dye Products." Regarding gender, males predominated in the survey, comprising 52.19%, while females accounted for 47.81%. In terms of age, respondents aged 25-34 were the majority, numbering 159, which represents 49.69% of the sample. Looking at household income, the largest group, numbering 183 respondents, fell within the 100,001 - 400,000 yuan range, accounting for 57.19% of the total. Regarding educational attainment, respondents with a master's degree were the most numerous, totaling 162 and representing 50.63% of the respondents. In terms of familiarity with plant dyeing, the largest subgroup, comprising 100 respondents, indicated a lack of understanding, accounting for 31.25% of the total. As for the frequency of purchasing plant dye products, those who buy once a year (usually) formed the largest group, with 96 respondents, making up 30% of the total.

#### 4. Research Results

Analysis of survey data revealed that infographics were rated as the most effective form of visual communication design due to their ability to present complex information in a concise and clear manner (Dur, 2014). Fashion show designs were valued for their practicality and educational worth, particularly among those with a keen interest in handicrafts. The specific contents of the visual communication designs are as follows:

##### 4.1 Extraction of Pigments from Dye Plants

Different dye crops have various cultivation, harvesting, storage, and pigment extraction methods. The principle of the indigo dyeing process is as follows: the stems and leaves of the indigo grass, when placed in water, undergo fermentation over time, hydrolyzing to release indigotin. Upon the addition of lime, indoxyl is liberated, which then undergoes oxidation in their and dimerizes to form indigo blue. (Figure 2)



Figure 2 : The Process of Making Indigo (Source: Produced by Author)

4.2 Methods of Plant Dyeing



Figure 3 : Visualization of the Indigo Making Process (Source: Produced by Author)

Indigo Production - Visualization Process (Figure 3):

1. Planting: Cuttings are planted annually between March and May.
2. Harvesting: Divided into summer and autumn harvests, occurring 2-3 times a year.
3. Soaking: The plants are submerged in a vat of water, allowed to ferment until the water turns blue and the indigo plants turn black, then the plants are removed and filtered.
4. Fermentation: A suitable amount of lime powder is added to the indigo water and left to sit for 1-2 days.
5. Oxidation: The mixture is agitated repeatedly until a large amount of purple foam forms on the surface, then the vat is covered.
6. Completion: The precipitated indigo liquid at the bottom of the vat is transferred into a permeable container to form a honey-like indigo paste, completing the production process.

4.3 Visualization of the Indigo Making Process

Table 2: Descriptive statistical analysis of research variables

	Name	Sample Size	Mean	Standard Deviation	Kurtosis	Skewness
Artistry	F1	320	3.638	1.291	-0.604	-0.698
	F2	320	3.669	1.278	-0.486	-0.775
	F3	320	3.563	1.268	-0.635	-0.610
Culturality	F4	320	3.862	1.108	0.553	-1.032
	F5	320	3.931	1.027	0.048	-0.770
	F6	320	3.922	1.141	0.596	-1.096
Traditionality	F7	320	3.634	1.272	-0.594	-0.658
	F8	320	3.553	1.271	-0.598	-0.655
	F9	320	3.681	1.279	-0.557	-0.726
Authenticity	F10	320	3.663	1.221	-0.329	-0.735
	F11	320	3.628	1.265	-0.373	-0.777
	F12	320	3.653	1.290	-0.520	-0.753

	Name	Sample Size	Mean	Standard Deviation	Kurtosis	Skewness
Emotionality	F13	320	3.712	1.231	-0.204	-0.847
	F14	320	3.778	1.173	-0.048	-0.861
	F15	320	3.719	1.245	-0.435	-0.747
Willingness to Participate in Plant Dye Fashion Exhibitions	D1	320	3.616	1.224	-0.521	-0.647
	D2	320	3.500	1.291	-0.770	-0.536
	D3	320	3.556	1.309	-0.700	-0.621
	D4	320	3.591	1.308	-0.588	-0.707
	D5	320	3.587	1.266	-0.646	-0.622
	D6	320	3.591	1.271	-0.695	-0.615
	D7	320	3.644	1.278	-0.561	-0.704
	D8	320	3.556	1.336	-0.712	-0.666

Based on the descriptive analysis results of the research variables, an analysis was conducted on two main variables in this questionnaire, including the design perception and cultural cognition of plant dye fashion exhibitions (artistry, cultural aspects, authenticity, and emotional engagement) and the willingness to participate in plant dye fashion exhibitions.

Table 2 uncovers the means for the design perception and cultural cognition of plant dye fashion exhibitions range between 3.553 to 3.931, with standard deviations ranging from 1.027 to 1.291. This indicates that respondents' perceptions of the design and cultural cognition of plant dye fashion exhibitions are moderately high; the means for the willingness to participate in plant dye fashion exhibitions range from 3.500 to 3.644, with standard deviations ranging from 1.224 to 1.336. In summary, it was found that there is a clear central tendency among the variables, with a similar degree of dispersion between the variables and measurement items, indicating stable data.

The main criteria for judging if sample data follows a normal distribution are skewness and kurtosis. The analysis results from the table show that the absolute values of skewness in the sample data are less than 1, and the absolute values of kurtosis do not exceed 3, meeting the general standard requirements for a normal distribution.

#### 4.4 Reliability and Validity Analysis

**Table 3:** Reliability and Validity Analysis

Reliability Results Analysis				
Name	Item	Corrected Item-Total Correlation (CITC)	Alpha if Item Deleted	Cronbach's Alpha Coefficient
Artistry	F1	0.645	0.731	0.802
	F2	0.658	0.718	
	F3	0.637	0.739	
Culturality	F4	0.613	0.598	0.741
	F5	0.546	0.679	
	F6	0.542	0.686	
Traditionality	F7	0.660	0.743	0.812
	F8	0.661	0.743	
	F9	0.664	0.740	
Authenticity	F10	0.608	0.740	0.791
	F11	0.611	0.737	
	F12	0.677	0.665	
Emotionality	F13	0.669	0.662	0.786
	F14	0.607	0.730	
	F15	0.603	0.736	
Willingness to Participate in Plant Dye Fashion	D1	0.708	0.913	0.921
	D2	0.734	0.911	
	D3	0.742	0.911	
	D4	0.744	0.910	

Exhibitions	D5	0.738	0.911
	D6	0.750	0.910
	D7	0.728	0.912
	D8	0.744	0.911

Table 3 understands that the Cronbach's Alpha (Tavakol & Dennick, 2011) coefficients for the measurement items within the variables of design perception and cultural cognition in plant dye fashion exhibitions, including artistry, cultural aspects, traditionality, authenticity, emotional engagement, and the willingness to participate in plant dye fashion exhibitions, are all above 0.70. Furthermore, in the CITC, the minimum value is 0.5421, greater than 0.5, indicating that the removal of any single item from the variables will not lead to an increase in the variables' Cronbach's alpha coefficient. This demonstrates that the questionnaire possesses good reliability.

#### 4.5 The validity testing of questionnaire data

**Table 4:** The validity testing of questionnaire data

	KMO Statistic Value	Bartlett's Test of Sphericity		
		Approx. Chi-Square	df	Sig
Artistry	0.712	299.141	3	.000
Culturality	0.679	214.503	3	.000
Traditionality	0.716	318.157	3	.000
Authenticity	0.697	285.027	3	.000
Emotionality	0.697	277.890	3	.000
Willingness to Participate in Plant Dye Fashion Exhibitions	0.944	1502.074	28	.000

To further ensure the accuracy of the research, this paper will perform a validity test on the survey questionnaire. Validity testing refers to the effectiveness, specifically the degree to which a measurement tool or method can accurately measure the intended entity. The KMO and Bartlett's Test of Sphericity, applied through SPSS statistical analysis software, will be used for the validity testing of questionnaire data. The KMO value ranges from 0-1, with values above 0.6 indicating acceptable validity. The results of the validity test are as shown in the table.

Based on the results of the validity test for each variable presented in the table, the KMO values for the dimensions of design perception and cultural cognition in plant dye fashion exhibitions are 0.712, 0.679, 0.716, 0.697, and 0.697, respectively; the chi-square values for Bartlett's Test of Sphericity are 299.141, 214.503, 318.157, 285.027, and 277.890, respectively. The KMO value for the willingness of respondents to participate in plant dye fashion exhibitions is 0.944; the chi-square value for Bartlett's Test of Sphericity is 1502.074. The significance levels in the aforementioned scale validity tests are all 0.000, indicating a P-value less than the 0.01 significance level. From this, it can be determined that the scales used in this study possess good validity.

#### 4.6 Regression Analysis

**Table 5:** Linear Regression Analysis

Results of Linear Regression Analysis (n=320)							
	Unstandardized Coefficients		Standardized Coefficients	t	p	Collinearity Diagnostics	
	B	Standard Error	Beta			VIF	Tolerance
Constant	0.319	0.224	-	1.425	0.155	-	-
Artistry	0.216	0.052	0.227	4.173	0.000**	1.679	0.596
Culturality	0.121	0.060	0.104	2.023	0.044*	1.506	0.664
Traditionality	0.189	0.048	0.199	3.943	0.000**	1.441	0.694
Authenticity	0.199	0.052	0.203	3.841	0.000**	1.591	0.629
Emotionality	0.159	0.051	0.157	3.140	0.002**	1.423	0.703
R2	0.448						
Adjusted R-squared	0.439						
F	F (5,314)=50.885,p=0.000						
D-W	1.914						
Dependent Variable: Willingness to Participate in Plant Dye Fashion Exhibitions							
* p<0.05 ** p<0.01							

Table 5 states that artistry, cultural relevance, traditionality, authenticity, and emotionality were used as independent variables, and the willingness to participate in plant dye fashion exhibitions was used as the dependent variable in a linear regression analysis (Montgomery et al., 2021). The model equation is: Willingness to participate in plant dye fashion exhibitions =  $0.319 + 0.216\text{Artistry} + 0.121\text{Cultural Relevance} + 0.189\text{Traditionality} + 0.199\text{Authenticity} + 0.159*\text{Emotionality}$ . The model's R-squared value is 0.448, indicating that these variables can explain 44.8% of the variation in willingness to participate in plant dye fashion exhibitions. The F-test for the model showed that the model passed the F-test ( $F = 50.885, p = 0.000 < 0.05$ ), suggesting that at least one of artistry, cultural relevance, traditionality, authenticity, or emotionality has a significant impact on the willingness to participate. Additionally, tests for multicollinearity showed that all VIF values were below 5, indicating no multicollinearity issues; and the Durbin-Watson (Rutledge & Barros, 2002) value was close to 2, suggesting no autocorrelation, and that there are no relationships between sample data, indicating a robust model.

The detailed analysis concludes that artistry, cultural relevance, traditionality, authenticity, and emotionality all have a significant positive impact on the willingness to participate in plant dye fashion exhibitions.

The experimental results indicate that after engaging with visual communication content, there was a significant increase in participants' overall awareness of plant dyeing crafts. Specifically, there was an average increase in awareness by 35%, signifying substantial progress among participants in understanding the technical details and cultural background of plant dyeing crafts. Moreover, participants reported a 50% increase in interest in practicing plant dyeing crafts, with 40% indicating their willingness to attend related workshops or activities to gain a deeper understanding and experience of the craft.



**Figure 4:** Visualization of Indigo Dyeing in Fashion Design (Source: Produced by Author) Figure 4 portrays that plant dyeing crafts are reinterpreted from a modern fashion perspective, demonstrating the feasibility of combining traditional skills with modern design concepts, and validating the driving force of visual design in the dissemination, education, awareness, innovation, and development of plant dyeing crafts.

By showcasing different applications of plant dyeing techniques (such as tie-dyeing, wax dyeing, etc.) on fabrics, the diversity and aesthetic beauty of plant dyeing technology are visualized. The contrast between different patterns and colors emphasizes the uniqueness of plant dyeing. Displaying the effects of plant dyes through actual products, rather than merely text or images, directly conveys the craft's visuals to the public. This fashion application display is an advanced form of visual communication that directly touches the audience's senses, enhancing cultural memory and identification.

These design works not only embody the artistic aesthetics of plant dyeing crafts but also showcase their sustainable innovative concepts, providing viable pathways and inspiration for the future inheritance and innovation of plant dyeing crafts.

## 5. Discussion and conclusion

Investigating effective visual communication strategies can result in sustained changes in behavior towards sustainable practices. Long-term studies can assess the impact of exposure to visuals promoting the eco-friendly aspects of plant dyeing on habits such as conscious consumerism, DIY crafting, and support for environmentally responsible brands. Exploring the cognitive associations formed through visual communication of plant dyeing, research can investigate how specific visual cues (e.g., natural color palettes, botanical motifs) influence memory retention and recall of information related to sustainable textile production. This could inform design strategies that optimize.

Examine the intergenerational impact of visual communication strategies on knowledge transmission and educational outcomes. Assess the effectiveness of targeting younger demographics with engaging visuals on plant dyeing in promoting lasting shifts in environmental literacy and sustainable skills acquisition. Investigate the role of visual communication in preserving cultural heritage associated with plant dyeing

traditions. Longitudinal studies can determine whether increased awareness of indigenous dyeing techniques fosters greater appreciation for cultural diversity and encourages efforts to safeguard intangible heritage.

The study confirms that the use of visual communication tools can significantly enhance public awareness and participation in plant dyeing crafts. Through narrative storytelling and step-by-step visualization, combined with creative fashion elements in fashion show presentations, it effectively increases public interest in and understanding of the culture, value, and techniques of plant dyeing crafts.

This research demonstrates how traditional crafts can be innovatively integrated with modern design to promote the education, dissemination, and innovation of plant dyeing crafts, providing a reference for the modernization of traditional crafts. Through the application of visual tools, this study highlights the potential of plant dyeing crafts in promoting environmental protection, economic development, and the cultural heritage of society. In realizing sustainable innovative design, it showcases the environmentally friendly characteristics of plant dyeing and, through innovative design ideas, brings new inspiration to the modern fashion and design fields.

The results encourage cooperation between disciplines, bringing together expertise in design, art, environmental science, and technology to collaboratively explore modern dissemination and innovative pathways for traditional crafts. Furthermore, the findings continue to develop and utilize various visual communication tools, regularly organize public education events and workshops, to enhance public awareness of plant dyeing crafts and their cultural and environmental values.

Hence, it is recommended that future research could delve into the application effects of visual communication across different cultural and social backgrounds. First, examine how contemporary artisans and designers are integrating plant dyeing techniques into their creative processes. Explore current trends, innovations, and adaptations of these traditional methods within the context of modern design and sustainability movements. Second, conduct comprehensive case studies and interviews with professionals, artists, and designers specializing in plant dyeing crafts. Gain insight into their methodologies, obstacles, and achievements. This qualitative approach can offer valuable perspectives on effective visual communication strategies. Lastly, cultivate partnerships between artists, scientists, and technologists to push the boundaries of plant dyeing. Engage in interdisciplinary research to explore new applications and cross-disciplinary approaches to visual communication.

### Authors' contribution

L. T and S.S has curated the research idea and designed the research, she composed the Introduction, Literature review, Hypothesis development, Methodology, and contributed to the acquisition of financial support for data collection and the verification of data analysis. L.T and S.S contributed to the data collection, quantitative analysis and the discussion and conclusions of the research.

### Declaration of competing interest

None.

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