

# Research on Design and Evaluation of Children's Handmade Paper Art Information Graphic in the Background of Big Data Analysis

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**Abstract**—Under the background of big data, the public's requirements for information are constantly improving, and information visualization has become one of the main forms of information presentation. Visual processing of information can optimize the visual experience and improve the reading efficiency of the audience. In this paper, the teaching activities of handmade paper art in children's art education are taken as an example to design information graphics, and the teaching process of handmade paper art is presented in detail in the form of graphics and characters complementing each other. Fuzzy evaluation model is used to evaluate and analyze the design results. The results show that the information graphic design of children's handmade paper art is reasonable, and the effect is outstanding. At the same time, it provides a new perspective for the observation and research of children's art teaching and solving strategies.

**Keywords**- Big data analysis; Handmade paper art; Information graphic design; Fuzzy evaluation model

## 1 Introduction

Big data is the source for people to gain new cognition and create new value. Its core is prediction, to realize the transformation from random samples to all data, from accuracy to hybrid, and from causality to correlation. Our society has entered the era of big data, a huge amount of information is generated every day. People's expectations for the analysis of increasingly placed information are increasing, and users' requirements for information storage and processing are getting higher and higher. Therefore, society has put forward new requirements for efficient screening and processing of information.

As shown in Figure 1, in the re-enrollment rate table of quality-oriented education and art education from 2015 to 2019, the re-enrollment rate in the field of art education has increased year by year, indicating that art education has a considerable development prospect under the requirements of quality-oriented education. It can be seen that the new era has put forward new requirements for the educational objectives of art courses. Therefore, art educators should also keep pace with the development of the times, make full use of the advantages of Internet + big data, and apply rich materials, information, and technology to the teaching of art courses to achieve innovation, so as to calmly respond to the new challenges posed by the development of the times.

Re investment rate of quality education and art education in 2015-2019

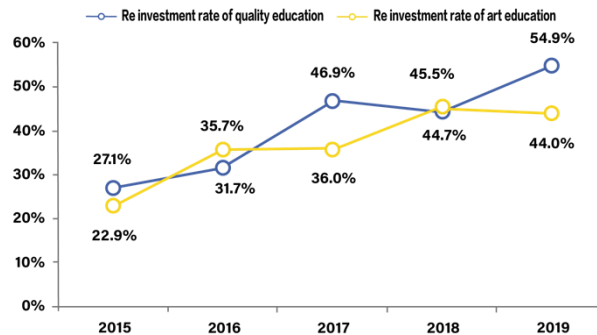


Figure 1 Re investment rate of quality education and art education in 2015-2019

As shown in Figure 2, in recent years, with the implementation of quality education and the improvement of people's living standards, the size of the art education market has grown year by year. From 2017 to 2019, the art education industry has grown steadily. In 2020, affected by the COVID-19, the size of the industry has shrunk. However, since 2021, the size of the art education industry is larger than that in 2019. With the support of national policies such as "aesthetic education into the secondary school entrance examination" and "double reduction policy", the development scale of art education industry continued to grow. The channels for people to obtain information about art teaching activities are diversified. The importance of children's art education is growing day by day. More and more attention is paid to teaching information, teaching content and teaching methods, which puts forward higher requirements for art educators [1].

Therefore, the most fundamental reason for the author's positioning of the topic in children's manual paper art teaching in art education is to explore a new way of art teaching that meets the needs of the development of the times. However, in actual teaching, teachers, students and parents do not fully understand the information of paper art teaching. The author presents the teaching content of manual paper art intuitively by means of information graphic design to help relevant audience groups better understand the relevant information of manual paper art teaching.

Market size and growth rate of China's quality education industry in 2017-2023

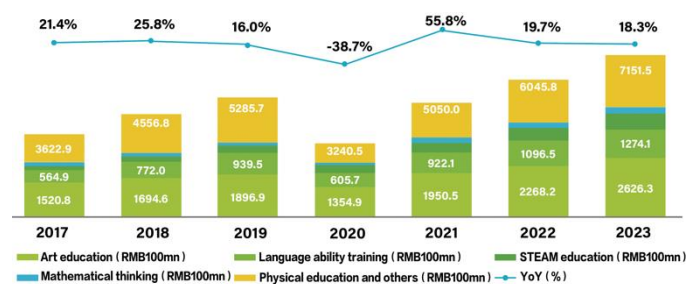


Figure 2 Market size and growth of China's quality education industry in 2017-2023

## **2 Overview of the related theories of children's handmade paper art information graphic design**

This section describes the concepts related to children's manual paper art and information graphic design, analyzes the reasons and design requirements for information graphic design of manual paper art teaching content, and lays a solid theoretical foundation for the design practice in the following text.

### **2.1 Children's Handmade Paper Art and Information Graphic Design Concept**

#### 1) Handmade paper art for children

Handmade paper art refers to the artistic expression form completed by bending, folding, carving, collaging and other techniques with various kinds of paper as the main materials. Children's handmade paper art refers to the activity of teaching handmade paper art to children aged 7-15 who can complete paper art production. The purpose is to improve children's artistic accomplishment and aesthetic ability, stimulates children's creativity and imagination, and promotes children's practical ability and thinking ability through handmade paper art teaching. Handmade paper art is mainly divided into three types: plane, semi stereoscopic and three-dimensional. The plane includes papercut and collage, the semi stereoscopic is mainly represented by derivative paper, and the three-dimensional is represented by origami and paper carving.

#### 2) Information graphic design

Information graphic design refers to the visual expression of information, data, or knowledge, which can quickly and effectively display and transfer information. In the context of global big data, graphical visual representation of information, as a way of effective understanding and rapid reception, has become a basic means of visual representation.

Information graphic design is a branch of information design, which represents data and information in a visual way. The types of expression include static information, dynamic information, and interactive information. This paper chooses a static way to represent the teaching content of children's handmade paper art. In the big data environment, people often need more powerful decision-making ability, insight discovery ability and information optimization ability, but people cannot capture, manage, and process huge data information in a certain time. Therefore, big data visualization is to analyze and process large amounts of data, present and optimize the information in a visual form, and display the analysis results to the audience intuitively [1].

### **2.2 The Necessity of Graphic Design for Children's Handmade Paper Art Teaching Information**

In today's era of extremely rich information and data explosion, the use of visualization technology fundamentally changes people's analysis and understanding of data or information, and the use of information graphic design can help the audience improve their understanding and memory of things. Graphics have a greater advantage over words and images in the process of information transmission. At present, the teaching methods of handmade paper art in the

market are mainly word of mouth, video teaching and drawing teaching. Word of mouth is easy to lead to deviation and loss of information understanding in the process of teaching. Although the process of video teaching is clear, it is difficult to understand and remember. It often requires repeated watching to understand, which is difficult for children. Therefore, the information graphic design makes use of its simple, clear, and easy to understand characteristics to visually express for teachers, students, parents, and other social groups. While providing comfortable visual enjoyment, it is convenient for the audience to quickly understand the specific content of manual paper art teaching.

### **2.3 The Value of Children's Handmade Paper Art Education Information Graphic Design**

#### 1) Reflect abstract information

Information graphic design can accurately represent the specific content of manual paper art. Because the teaching process and content of manual paper art are relatively abstract and vague, graphic design can clarify the specific information content required by users. The intrinsic value of information graphic design is to accurately convey the hidden information to the audience accurately and easily, so that the design can serve the information.

#### 2) Beautify the visual experience

As a borderless language, the interpretation of graphics is related to the effectiveness of information transmission. Compared with words and sounds, the information transmission effect of graphics is better. Through gorgeous colors and exquisite typesetting, the children's manual paper art teaching activity painting is invisible and tangible, reducing the audience's fatigue caused by too many words or jumbled information in the reading process. Different individuals have different acceptances of information. When designing information visualization, they do not need to pursue gorgeous and complicated styles. Clear logic, simple and plain pictures are more intuitive and popular in the process of information transmission, considering the effect of information transmission and visual experience.

#### 3) Reduce dyslexia

In design, the designer layers and guides the complex information in a targeted way, reasonably arranges the viewing process, and adopts the method of dot with line to intersperse each visual element in a primary and secondary way. The information process fully follows people's reading habits and the law of vision flow, so that the viewer can browse more smoothly, and the user can understand the logical relationship of information in the shortest time, so that the audience can be deeply impressed with the information conveyed by the designer.

## **3 Graphic design display of children's manual paper art teaching information**

Paper art is one of the most common and important teaching activities in children's art education. Carrying out paper art activities in teaching can not only cultivate children's practical ability and creativity, improve their interest in classroom teaching, but also cultivate their spirit of

cooperation. The author transforms the types, techniques, and paper materials of handmade paper art into graphics to achieve the goal of clear teaching steps of handmade paper art.

### 3.1 Visual conversion of manual paper type

There are various categories of handmade paper crafts, as shown in Figure 3, mainly including the following five.

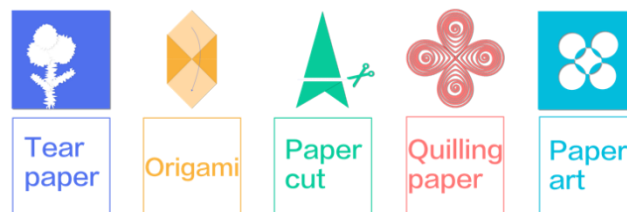
**Tear paper.** In the handmade paper art activities, the difficulty of tearing paper is relatively low. Through the actions of pulling, pulling, tearing, pulling, etc., the paper of the required shape is obtained, and then a complete work is formed in the form of collage.

**Origami.** Although manual origami does not require the help of other tools, it can create a flat sheet of paper through different operations such as folding, folding, pressing, etc., to get rid of the original shape of the paper and give it a new dynamic image [2].

**Paper-cut.** Through the effective cooperation of scissors and paper, a highly artistic work is formed.

**Paper-Rolling.** It is a semi-three-dimensional art in which various colored paper strips are formed into small parts by means of curling, pressing, kneading, and pushing, and then combined.

**Paper sculpture.** Paper sculpture is a three-dimensional art that uses paper as the material to shape with props.



**Figure 3** Visual transformation of types of handmade paper art (Drawn by the author)

### 3.2 Visual conversion of handmade paper techniques

As shown in Figure 4, the handmade paper art techniques mainly include 10 kinds of tearing, collage, adhesion, flipping, overlapping, pressing, cutting, curling, engraving and kneading.

**Tear,** to obtain irregularly shaped paper on a sheet of paper through the motion of hand tearing.

**Collage,** where paper, pieces of cloth, or other materials are attached to a two-dimensional surface.

**Adhesion,** through viscous media, such as glue, glue stick, tape, etc., to collage and combine the parts of the work.

**Flip,** by folding, to form a new shape.

**Overlapping,** stacking paper layers on top of each other, increasing the thickness of the paper.

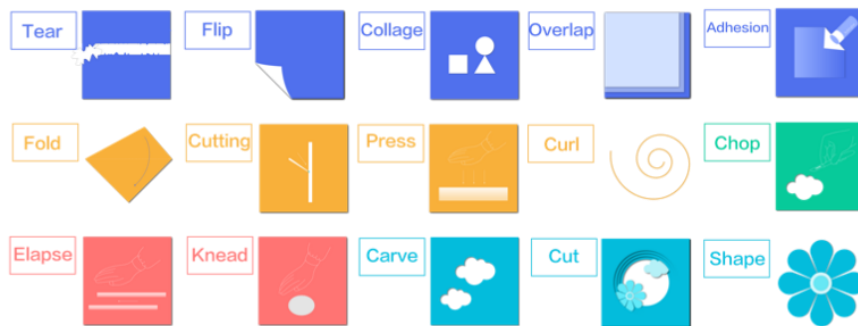
Press to compress the space formed by overlapping or kneading the paper with the help of external force to reduce the thickness of the paper.

Cutting is the process of combining paper materials by plugging with the help of the space of paper folding and without the help of adhesion medium.

Curl, bend or turn the paper, from two-dimensional to three-dimensional.

Engraving is a creative process in which a sharp tool is used to obtain a hollow form by penetrating the paper.

Kneading, the process of applying partial or overall pressure to the paper by hand to create a special texture effect.



**Figure 4** visual transformation of handmade paper arts (Drawn by the author)

### 3.3 Graphic Design Display of Handmade Paper Art Teaching Information

As shown in Figure 5, the combination of the above-mentioned techniques and paper materials can form different types of manual paper art activities, making children's manual paper art teaching activities clearer and more intuitive.

## [ Children's handmade paper craft ] infographic

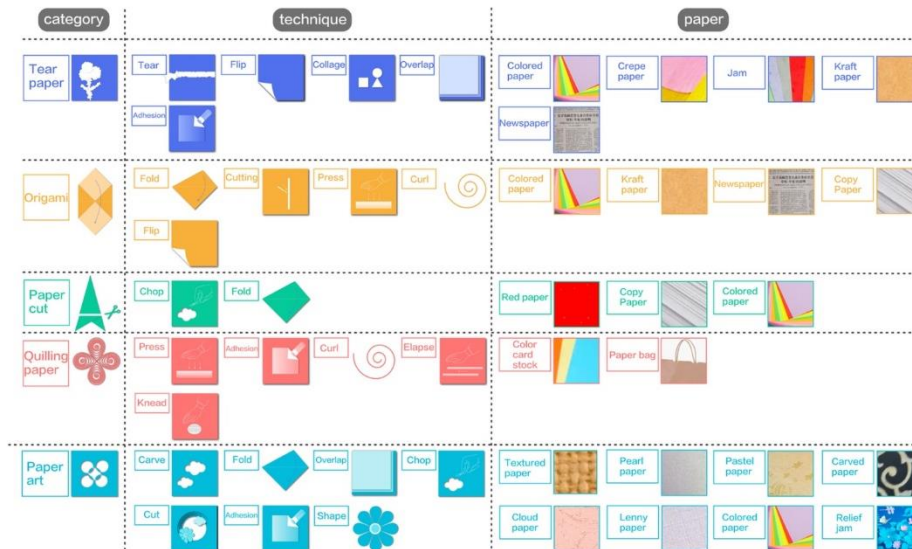


Figure 5 Children's Handmade Paper Art Information Graphic Design (Drawn by the author)

### 4 Evaluation of Fuzzy Comprehensive Model for Children's Handmade Paper Art Information Graphic Design

The fuzzy comprehensive model was developed by A Zadeh Professor, proposed that we should make a general evaluation on the things or phenomena with various influencing factors and perform fuzzy factors on the most significant characteristics in the evaluation process [3]. In the graphic design of manual paper art teaching information, the presentation of teaching content information involves various complex and uncertain factors, and it is difficult to use standardized analytical methods for quantitative analysis. Therefore, fuzzy model is used for evaluation, which mainly consists of four dimensions (C, V, R, W), where C is the evaluation vector set, V is the evaluation semantic set, R is the fuzzy matrix, and W is the weight coefficient set [4].

Firstly, a general set of factors affecting the evaluation object is formed. In the manual paper art information graphic design, when viewing the information graphic design results, different evaluation subjects are vague about the beauty and ugliness of the design visual effect, the simplicity and complexity of the visual information, the number of graphics, the speed of reading, the size and size of the information graphic, etc. The author forms a set of the above five subjective fuzzy concept evaluation items, which are expressed by C, then  $C = (C_1, C_2, \dots, C_n)$ . Because the importance of each factor to the evaluation results is generally different, each factor is given corresponding weights. The set of weights is  $W = (W_1, W_2, \dots, W_n)$ , the evaluation matrix  $R = (R_1, R_2, \dots, R_n)^T$ , and  $R_i$  is the single factor evaluation result of the evaluation factor

$C_i, R_i = (r_{i1}, r_{i2}, \dots, r_{im})$  [5]. The evaluation matrix  $R$  can be seen as a process from C-to-V, representing a fuzzy relationship from C-to-V. If  $u$  is the membership function of the fuzzy model and  $0 \leq u \leq 1$ , the survey scale is constructed by combining the evaluation semantic set and the evaluation vector set, as shown in Figure 6.

$W$	$C$	$V_1$	$V_2$	$V_3$	$V_4$
$\omega_1$	$C_1$	$u_{11}$	...	...	...
$\omega_2$	$C_2$	...	$u_{22}$	...	...
...	...	...	...	...	...
$\omega_9$	$C_9$	...	...	...	$u_{94}$

**Figure 6** Children's handmade paper art information graphic design evaluation scale

This fuzzy evaluation takes 5 design teachers, 10 design students, 10 non art students, 10 children's manual paper art related practitioners, and 15 children aged 7-15 as the main evaluation subjects. Because different individuals have different visual feelings towards the information graphic design results of manual paper art, the evaluation results are different.  $V = \{V_1, V_2, V_3, V_4\} = \{\text{Outstanding, Excellent, Good, Qualified}\}$  is taken as the evaluation set  $\beta = (90, 80, 70, 60)^T$  is assigned to the comment set.

As shown in Table 1, 50 evaluation subscales were collected, and the data were analyzed by SPSS data fuzzy evaluation.

**Table 1** Weight calculation results

	outstanding	excellent	good	qualified
Membership	0.120	0.090	0.100	0.075
Normalized membership [weight]	0.312	0.234	0.260	0.195

It can be seen from the above table that the weight value of outstanding in the four comment sets is the highest (0.312). Combined with the maximum subordination rule, the final comprehensive evaluation result is "outstanding"[6].

## 5 Conclusions

Handmade paper art, as an important part of aesthetic education, can greatly promote the development of students' observation ability, practical ability, design ability, imagination, creativity, aesthetic ability, etc., and has high research value. With the help of information graphic design, it presents the teaching process and skills of children's paper art in the form of graphics and words. This paper conducts a questionnaire survey on the design of design achievements, and uses the fuzzy comprehensive evaluation model to analyze the research results, which verifies the applicability of the information graphic design of children's manual paper art. The future society is bound to be an era of rapid information development. The related research of information graphics discipline is of great significance to the rapid development of



society and the renewal of people's modern living standards. The author sincerely hopes that this paper can provide a reference sample for paper art researchers. I hope that information graphic design can be more widely used in the field of art education in the future, make contributions to the basic art education, and provide clearer teaching ideas and methods for front-line art educators.

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