




The Intangible Heritage of Mogao Grottoes Mural Characteristics: Educational Role of Pattern Art and Its Impact on Art Education

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ABSTRACT

The murals of Mogao Grottoes have a variety of different patterns, and the study of the intangible inheritance of their pattern characteristics will be conducive to the further understanding of Mogao Grottoes murals in later generations, and improve people's enthusiasm for the modern art application of Mogao Grottoes murals. To this end, this paper takes the murals of Feitian, Nine-colored Deer and Thousand Buddhas as samples, and uses the Sanyo 200 infrared scanner and Sankeng electron microscope to observe the characteristics of dye composition, pattern painting thickness and figure modeling in the murals of Mogao Grottoes, and summarizes their pattern characteristics, artistic value and intangible inheritance significance. The results showed that the dye components of the murals in the Mogao Grottoes were cinnabar, stone blue and garcinia cambogia as the main dyes, and the dye components reacted with the components in the stone wall to form a medium oxidation protective layer and improve the corrosion resistance of the murals. The dye thickness of the mural is 1~2 cm, and the dye is mostly 3 layers. The figure modeling of the mural is mainly composed of the left 1/4, the composition is biased to the right, and the lines are mainly streamlined and long. The patterns in the murals of Mogao Grottoes are mainly Buddhism and Taoism, paying attention to the integration of colors, and the figure structure is also relatively modest, which belongs to the integration of Chinese and Western cultures. Therefore, the colors in the murals of Mogao Grottoes are complex, the figures are reasonable, and the artistic connotation is profound, which promotes the development of modern art education ideas and contents.

Keywords: Mogao Grottoes, Pattern Characteristics, Intangible Inheritance, Pattern Art, Design Value, Art Education.

INTRODUCTION

The murals of Mogao Grottoes have always been one of the treasure houses of ancient Chinese art, with rich content, diverse colors and shapes, and a long historical cycle. The mural is extremely wonderful and rich in content, showing exquisite painting skills, with a strong historical and cultural heritage of the Tang and Song dynasties (618~1279 AC), rich in connotation, and is an ideal sample for current archaeological research. The murals of the Mogao Grottoes have far-reaching historical and cultural value, and some scholars believe that their archaeological value is mainly in terms of color and line, and also covers some of the thematic content (Bi et al., 2021). Most of the murals in Mogao Grottoes were created between the 4th century and the 14th century AD. The themes cover various religious and secular themes, which can reflect the social outlook, political atmosphere, and religious content at that time, and have great research value. The artistic value of the murals in Mogao Grottoes is extremely huge. The murals in Mogao Grottoes are cute and exquisite, and the colors are often very bright. They have the advantage of exquisite composition, vividly showing the social scenes, life scenes, and religious beliefs of ancient China. It can be said that the murals in Mogao Grottoes also have high cultural value. For example, many of the works in the murals of Mogao Grottoes show the history of cultural exchanges in ancient Chinese society and witness the fusion of ancient Chinese and foreign cultures. The murals of Mogao Grottoes cover religion,

philosophy, art, etc., which are currently a hot topic for archaeologists and a major research sample, which has had a great impact on modern art education (Cao, Yan, Chen, Tian, & Ma, 2021). Some scholars believe that the murals of the Mogao Grottoes are an important historical and cultural heritage in China, which can record the history of the Tang and Song dynasties in detail, and show the artistic value of the time through colors and lines, so as to provide material support for archaeological research. Some scholars believe that the intangible inheritance of the characteristics of the murals in the Mogao Grottoes, the educational value of pattern art, and its influence on art education will be studied in depth, so as to better protect and inherit the cultural heritage value of the murals in the Mogao Grottoes, enhance the self-confidence of the creation of national murals, and provide inspiration for the creation of modern paintings (Chai et al., 2022). Dunhuang Mogao Grottoes is a grotto that began to be excavated during the Northern and Southern Dynasties, and its historical and cultural value is mainly reflected in two aspects: on the one hand, it can carry the Tang and Song dynasties (618~1279 AC) The cultural connotation, Western exchanges and social and economic development have the value of pictorial historical records, which can fully reflect the spiritual outlook of the society at that time, and the archaeological excavations in the later period provide graphic data and correspond to the documentary materials, verify the cultural content of the Tang and Song dynasties, and guide modern archaeology to excavate murals, in addition, the Dunhuang Mogao Grottoes is an art form that integrates the cultural characteristics of the West and the Central Plains, not only showing the skills of traditional Chinese painting, such as the flexibility of lines, the thickness of lines and the expression of line modeling, but also reflecting the Tang and Song dynasties (618~1279 AC) The differences between China and the West in terms of dye, color, and modeling further reveal that the Chinese painting art form at that time provided support for modern art creation, the inheritance of cultural connotation, and the design of cultural and creative products, so it is said that the Mogao Grottoes in Dunhuang have dual value in terms of history, culture and painting art, which can not only guide the development of archaeology now, but also provide support for the development of modern culture and creativity.

LITERATURE REVIEW

Protection and Restoration of the Pattern Characteristics of the Murals in the Mogao Grottoes

Physical protection and environmental protection. We should carry out very strict and effective physical protection of the murals of the Mogao Grottoes, and in fact, the protection measures have been carried out all the time, including controlling the number of visitors and limiting the time of daylight so as to reduce the damage to the murals of the Mogao Grottoes. In addition, a large number of staff members have been working to effectively protect the environment where the Mogao Grottoes murals are located, and specific protection measures include vegetation restoration and soil and water conservation so as to keep the environment of the Mogao Grottoes murals stable. Secondly, the restoration work. For the damaged patterns in the murals of the Mogao Grottoes, people need to carry out the necessary restoration work, such as taking professional technical measures or using relevant materials to complete local repair and protection. The most important thing in the restoration work is to restore the original pattern features as clearly as possible and prevent the damage from aggravating (Duan et al., 2021). Second, the inheritance of cultural values. The first is digital protection and dissemination. With the help of advanced technologies, such as digital scanning and 3D reconstruction, people can digitally record mural patterns in the Mogao Grottoes and create digital archives with high precision. It can not only reduce the impact of people's visits to the murals of the Mogao Grottoes, but also use the online platform to carry out relevant dissemination and teaching, and then improve the application value of precious cultural heritage. Second, academic research and education popularization. Schools should be able to support and encourage students to conduct in-depth research on the murals of the Mogao Grottoes, such as the study of the artistic style, historical background, and techniques of the murals of the Mogao Grottoes. In addition, all parties can also incorporate relevant content into university education and public education to raise people's awareness of the cultural and artistic value of the Mogao Grottoes murals, and stimulate the new generation's interest in the research and protection of the precious heritage of the Mogao Grottoes. Then, the revival and training of traditional skills (Han et al., 2022). People can excavate and revive the traditional skills in the production of Mogao Grottoes murals, and cultivate the new generation to inherit the techniques and skills of Mogao Grottoes murals by holding training classes or setting up special studios. Through a certain amount of practical operation, more people can master ancient skills to ensure that the relevant knowledge of Mogao Grottoes murals will not be gradually lost due to the passage of time.

Digitization of the Mural Heritage of the Mogao Grottoes

The digital preservation of heritage can be carried out by applying high-resolution scanning technology and 3D imaging technology to effectively preserve the murals of the Mogao Grottoes, so that the original murals can be effectively protected and remote research and analysis can be facilitated. Secondly, the literature is collated. It is necessary to systematically sort out the historical documents, academic papers, and research reports related to the

compilation of the murals of the Mogao Grottoes and establish a systematic database for them to provide rich and reliable reference information for the research of relevant personnel. Then there is the analysis of the pattern features. It is necessary to carry out a specific analysis of the pattern characteristics of the murals in the Mogao Grottoes, including the analysis of their pattern style, color, composition, lines, etc., and the cultural meaning and artistic value behind the elements (Hao et al., 2022). Then, interdisciplinary collaboration. There is a need to support and encourage cross-disciplinary collaboration among experts in order to facilitate the study and documentation of the pictorial characteristics of the Mogao Grottoes. Finally, public education and presentation. People should display various research results on the pattern characteristics of the murals in the Mogao Grottoes, so that the public can deepen their knowledge and understanding of the pattern characteristics of the murals in the Mogao Grottoes. At the same time, relevant personnel should also actively popularize the artistic knowledge of Mogao Grottoes murals through exhibitions and lectures to improve the audience's awareness of the inheritance and protection of the cultural heritage of Mogao Grottoes.

METHODOLOGY

Subjects

This paper takes the murals of "Flying Sky", "Nine-colored Deer" and "Thousand Buddhas" commonly used in modern cultural and creative design as samples. The lines and shapes are obviously representative, for example, "Flying Sky" is mainly light color, "Thousand Buddhas" is mainly dark color, "Nine Colored Deer" color is more comprehensive, and the shape and lines of "Flying Sky" are Tang Dynasty (618~907 AC), "Nine Colored Deer" and "Thousand Buddhas" are representatives of Song Dynasty (960~1279 AC) paintings, so it is more universal to choose the above three samples as research objects, and the characteristics of dye composition, pattern painting thickness and character modeling in the murals of Mogao Grottoes were observed by using Sanyang 200 infrared scanner and Sankeng electron microscope. Among them, the infrared scanner mainly tests the heat resistance of the sample's surface and the dye's main components. The sample is observed microscopically, the composition of the sample is evaluated, and the infrared scanner is used for verification to obtain more accurate results. The three-keng electron microscope is mainly to observe the image structure and artistic modeling of the sample, as well as the thickness of the dye, the surface oxide of the painting, and the fusion effect of the dye with the stone wall. Compared with other methods, infrared scanners and microscopes have the advantages of no damage, no contact, and easy operation, making it easier to test mural samples.

Dye Composition

Through infrared scanners and microscopes, it was found that the main components of the mural are shown in Table 1.

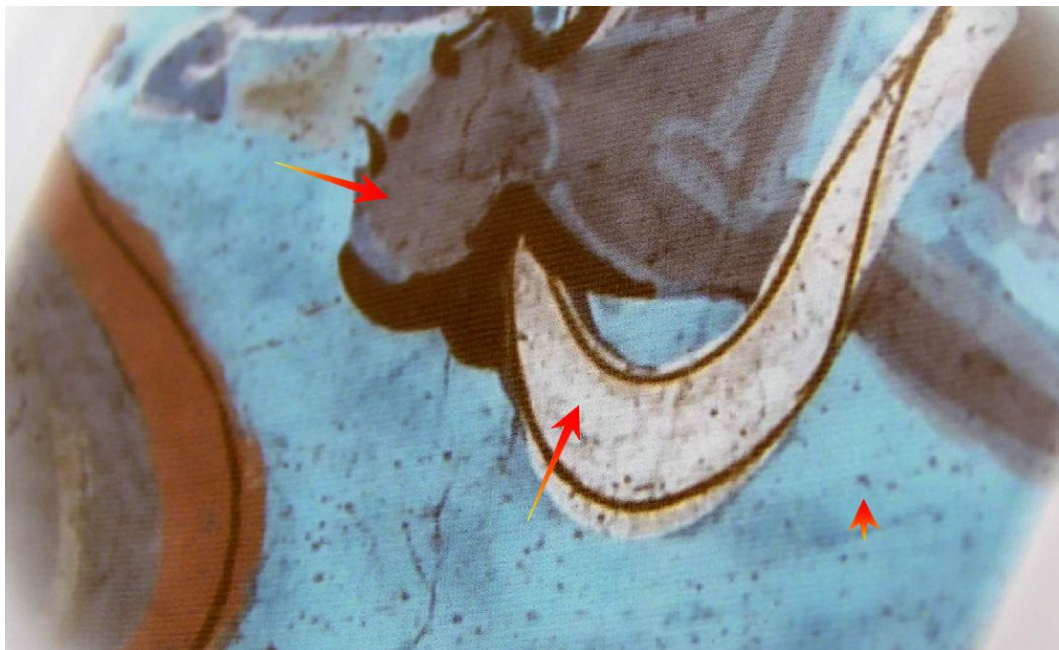
Table 1. The Dye Composition of the Sample

Sample	Dye ingredients	The presence or absence of oxides on the surface
Flying	Gypsum, $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$, AlSiO_4 , Fe_3O_4 , AlSiO_4 , orpiment	exist
Nine-colored deer	Gypsum, kaolin, chalk	exist
A thousand Buddhas	Pb_3O_4 , Fe_2O_3 , Yellow Dan, orpiment, realgar, Fe_3O_4 , AlSiO_4 , $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$, AlSiO_4	exist

From the analysis in Table 1, the dyes of Thousand Buddhas are mainly yellow and contain a large amount of Fe_3O_4 and AlSiO_4 . Among them, $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$ is an unstable oxide that turns green in the humid environment of the Mogao Grottoes. The nine-colored deer is predominantly white, mainly gypsum, kaolin, and chalk. The types of dyes that fly to the sky are second, which are orpiment, gypsum, $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$, etc. The dyes of the nine-colored deer are relatively stable, while Feitian and Thousand Buddhas dyes are unstable and prone to color change, as shown in Figure 1.



A Thousand Buddhas



Flying

Figure 1. Comparison of the Dyes of the Thousand Buddhas and the Flying Heavens

Through microscopic observation, it was found that the dyes of the nine-colored deer and Feitian contained many granular substances, which were $\text{CuCO}_3 \cdot \text{CuCO}_3$ particulate matter produced after $\text{Cu}(\text{OH})_2$ oxidation. The patterns in the murals of the Mogao Grottoes have a balanced color matching, which is beautiful and generous and conveys a lot of valuable content through color, including religion, history, cultural information, etc. The blue and white are beautiful and generous, and the combination of yellow and red forms an extremely colorful mural (He et al., 2021). Under the effect of exquisite painting skills, the rich colors can bring a high degree of visual enjoyment to the audience, make people feel more pleasant, and highlight the vividness of the murals. Different colors can convey cultural and religious information and also reflect the relationship between religion and historical and cultural information, for example, yellow, red, and white display Buddhist stories and historical events, which can effectively reflect traditional Chinese culture. The practical application value of color matching rich colors has the value of collection and appreciation and a certain religious ritual, with high practical value.

Thickness of the Coating

Using a microscope to observe the surface of Dunhuang murals, it will be found that their thickness and lines

are beautiful and artistic, as shown in [Figure 2](#).

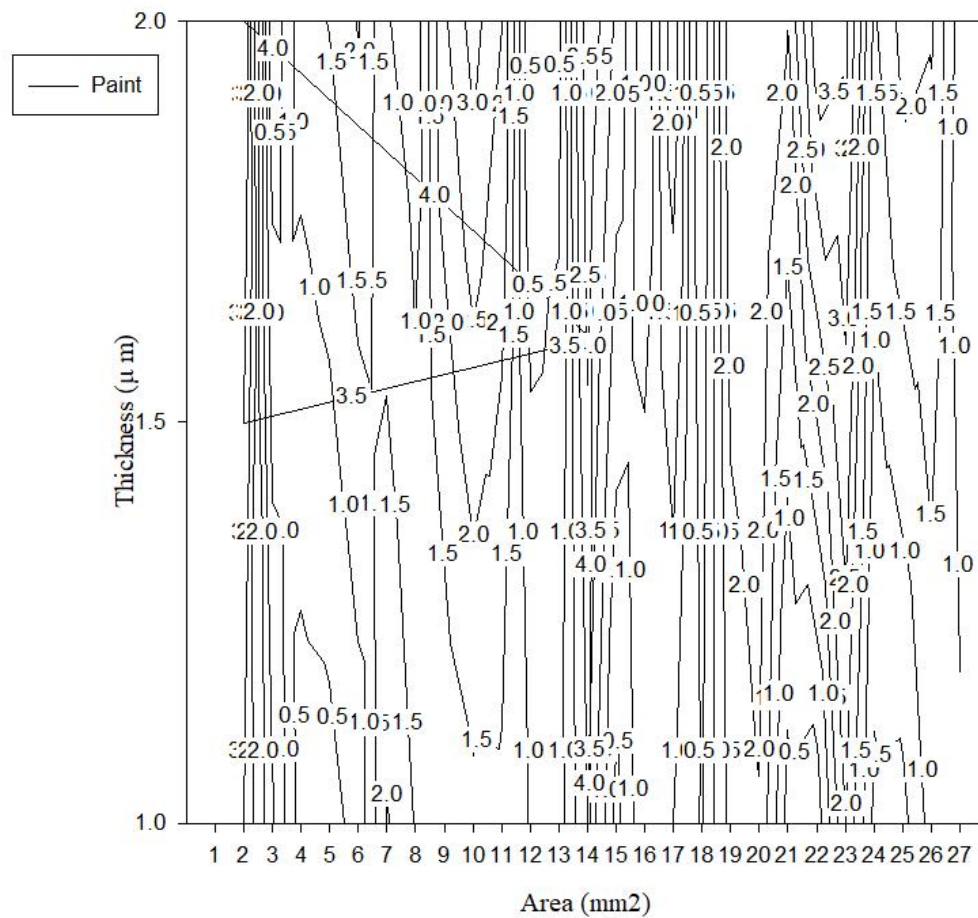
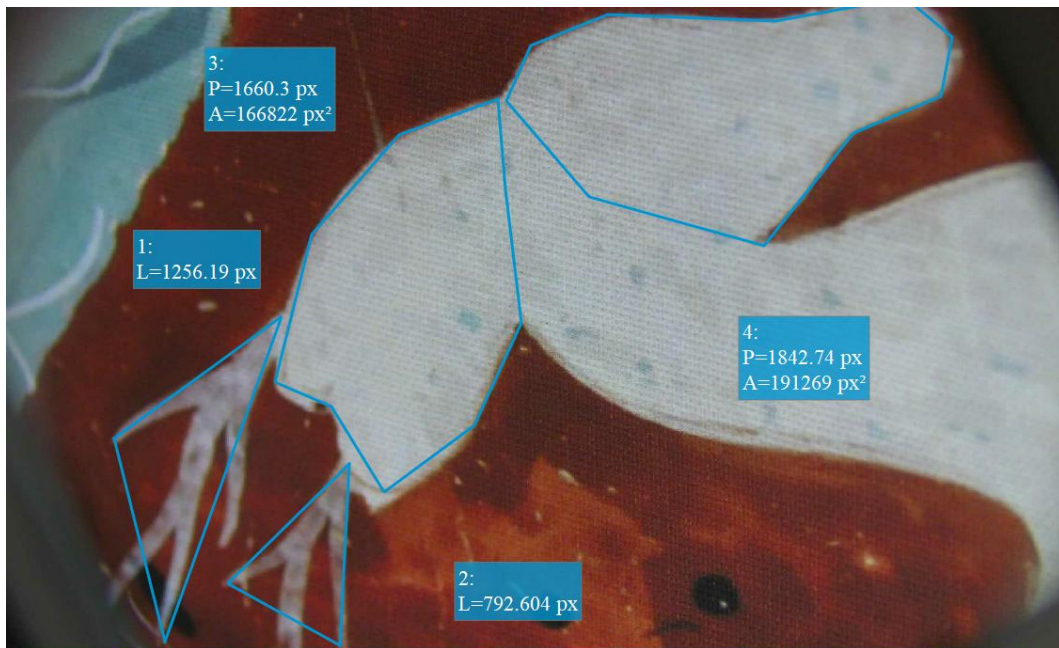


Figure 2. Comparison of the Thickness and Area of the Painting

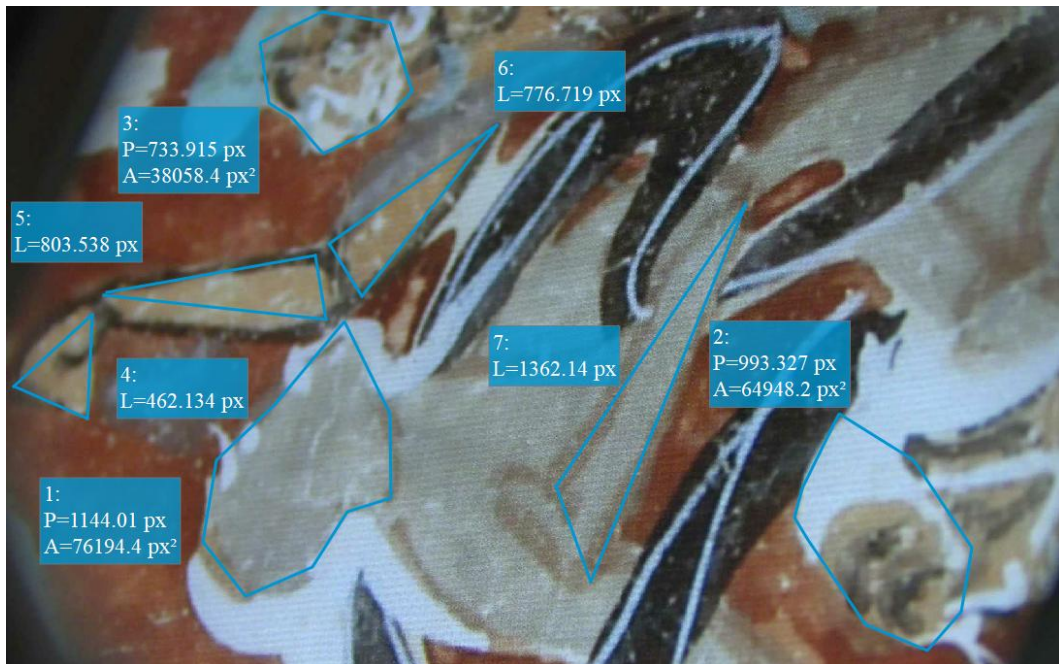
The average thickness of the paintings in [Figure 2](#) is $1.5 \mu\text{m}$ and the area is 15 mm^2 . Among them, the painting points with an area of 3 mm^2 , 15 mm^2 and 23 mm^2 have frequent color changes and large fluctuations in the thickness curve, indicating that the Dunhuang murals attach great importance to the vivid display of characters and scenes, and use a variety of colors to paint the murals, rather than large-scale color drawings. Based on the use of color and effective line outlining methods, the Mogao Grottoes mural patterns can convey different themes and emotions, and then show a variety of visual effects to express the different emotions of the characters. First of all, the use of color. The Mogao Grottoes murals can highlight the theme and convey a variety of different emotions and atmospheres, such as solemnity, mystery and festivity. Secondly, the line outline. The lines of the mural patterns in the Mogao Grottoes are very smooth and vivid, which can be used to outline a variety of images and scenes so as to improve the visual impact of the work and improve the sense of dynamic experience (M. Li, Wei, Wan, & Li, 2021). Based on this, people will better understand the information on the topic. Finally, visuals and emotional expression. Through a variety of meticulous depictions and careful compositions, combined with the layout, the Mogao Grottoes murals create many layered visual effects, based on which they can express the connotation and emotion of deep and rich.

Modeling of Mural Patterns

Comparing the figures of the two different murals, it will be found that there are certain similarities in the figure shapes, mainly triangles and circles, as shown in [Figure 3](#).



Nine-colored Deer



A Thousand Buddhas

Figure 3. Comparison of the Shapes of Different Murals

From the comparison of the figures in the different murals in Figure 3, it is found that the shapes of "A Thousand Buddhas" and "Nine Colored Deer" are mainly triangular and circular, indicating that the murals in the Mogao Grottoes are mainly simple teaching, and their design concepts are similar to the current painting art and sketch art. The drawing of triangles and circles can highlight the artistic value of the mural figures in the Mogao Grottoes and make the characters more vivid. By matching different colors, the character shape can be more colorful and rhythmic, making the character more coordinated as a whole. Through the display of triangles and circles, the patterns of the murals of Mogao Grottoes have high artistic education value, and their artistic aesthetics and expressions are mainly reflected in several aspects: First, the artistic aesthetic value is higher. The patterns of the murals in the Mogao Grottoes have gorgeous colors, smooth lines, and vivid shapes, which can exhibit high artistic aesthetic value, thus bringing a strong visual experience and sensory enjoyment to the audience and have a profound aesthetic experience. First of all, brilliant and colorful colors. The pattern design of the Mogao Grottoes murals is very beautiful, and its color use is very rich, which can show diverse and gorgeous visual effects so that the audience can feel an extraordinary beauty and have a pleasant aesthetic experience.

Secondly, the lines are smooth and vivid. The patterns of the Mogao Grottoes murals have smooth lines and a great sense of rhythm, which can outline the form with vitality and movement so that the audience can have a harmonious viewing experience. Secondly, shows different forms of representation. The mural patterns in the Mogao Grottoes are deeply integrated with traditional Chinese paintings, Buddhist art, and cultural elements of the Western Regions, so they have shown a variety of expressions (S. Liu, 2021). First, the integration of traditional Chinese painting techniques. The patterns of the murals in the Mogao Grottoes are influenced by traditional Chinese painting techniques and aesthetic concepts. For example, many of the murals in the Mogao Grottoes use coloring, line drawing, perspective techniques, etc., and pursue a style full of artistic conception and unique emotional expression. Polygons have been added to the shape of A Thousand Buddhas, indicating that the form of painting and Buddhist art are fused, evolving based on a circle. The polygon is oval as a whole, similar to the relics of Buddhism, indicating that the murals of the Mogao Grottoes are one of the nodes of Buddhist cultural transmission, and their patterns are basically integrated with a Buddhist element, such as the images of religious figures such as Buddha and Bodhisattva, and related religious storylines, etc., which can reflect that the mural patterns of the Mogao Grottoes are obviously influenced by Buddhist art, and are manifested explicitly in form and content. Thirdly, the shape of the triangle is the main shape, indicating that the shape and the cultural elements of the Western Regions are integrated with each other. Because of the geographical location, the design of the murals in the Mogao Grottoes was obviously influenced by the cultural elements of the Western Regions on the Silk Road. The murals of the Mogao Grottoes not only contain a lot of Chinese-style pattern design content, but also contain a lot of Indian or Persian pattern styles and symbols, so the elements together constitute a more diverse and unique art (Liu et al., 2022).

Color Protection of Murals

As an important research content, the color of Dunhuang murals in the Tang Dynasty can be preserved for a long time, mainly due to the protective layer on the surface of the color. The observation of the murals, such as Thousand Buddhas and Feitian, shows a certain oxide layer on the surface of their colors, and the results are shown in Figure 4.



A Thousand Buddhas



Flying

Figure 4. The Protective Layer on the Surface of the Mural

From the measurement results in Figure 4, it can be seen that there is a certain protective layer on the surface of the Dunhuang murals to protect the color and prevent it from falling off or fading. The observation results show that the protective layer is mainly FeO, PbO, AlO, and CuO oxides. Among them, AlO is more protective and can prevent further oxidation of dyes such as Pb and Cu. However, due to the presence of substances such as Cu(OH)₂ and gypsum in the dye, alkaline substances can form in a humid environment, causing corrosion to the murals. Therefore, murals such as Flying Heaven and Thousand Buddhas should avoid getting wet. In the Dunhuang area, the air humidity is low, dry, and hot, so the murals are well preserved. Due to the protection of surface oxides, dyes can provide much inspiration for the creation of modern art and promote the continuous development and evolution of artistic expression (Liu et al., 2023). This shows that the mural creators of the Tang and Song dynasties not only painted the murals, but also took great pains to protect the murals. The dyes of murals such as "Flying Heaven" and "Thousand Buddhas" contain CaCO₃ to adjust the dryness and humidity of the surface of the murals, and combine with dyes such as Cu(OH) to adjust the acidity and alkalinity. CaCO₃→CaO, Cu(OH)→CuSO₄ can adapt to the humidity environment of 10~20%, which has a significant protective effect on murals. As a result, Dunhuang murals not only have high excavation value in art design, but also have obvious research value in the protection of technology.

Yellow, red, and orange are the unique styles of the Mogao Grottoes mural patterns, with rich and colorful content, all of which provide a lot of inspiration for modern graphic art educators and are their source of inspiration. Brown, green and other special dyes are popular in Europe, reflected in the mural patterns of Mogao Grottoes, so Thousand Buddhas and Feitian are the products of different cultural exchanges and integration (Liu et al., 2023). During the Tang and Song dynasties (618~1279 AC), the blue and yellow dyes in the Central Plains were mainly plant dyes, the dyeing effect was poor, and the dyes were easy to oxidize. At the same time, inorganic dyes appeared in Europe, and dyes were mainly obtained by inorganic chemical synthesis. At the same time, the Dunhuang area was a necessary place for the ancient Silk Road, and the trade between China and the West was frequent, which provided objective support for the introduction of inorganic dyes. In essence, the existence of the pattern and color characteristics of the murals in the Mogao Grottoes is the comprehensive result of history and culture, and the study of traditional colors also provides a reference for the continuous transformation and development of modern artistic expressions. With the continuous emergence of new materials and new technologies, the colors in the murals of Mogao Grottoes have become more diverse, and many traditional patterns and painting techniques have been inherited, which has a certain role in promoting modern innovation(Liu et al., 2022).

THE INFLUENCE OF THE MOGAO GROTTOS PATTERN ON MODERN ART EDUCATION

Improve the Cultural Connotation of Art Education

Modern visual arts education can draw inspiration from the murals of the Mogao Grottoes. The murals of the Mogao Grottoes have a variety of pattern characteristics, such as unique lines, diverse colors, and symbolic characteristics. Visual arts educators get a lot of inspiration to break new ground in their creations. Art educators can draw on the traditional pattern characteristics in the murals of the Mogao Grottoes to create different visual works, thus combining traditional aesthetics with modern graphic art education concepts. The murals of the Mogao Grottoes have been widely used in modern fashion and product education, which can enhance students' interest. For example, modern clothing and accessories, education, furniture decoration, etc., all have many characteristic elements of the Mogao Grottoes murals (Ma et al., 2023). The application of characteristic elements not only promotes the continuous popularity and dissemination of traditional Chinese culture but also improves the cultural value of commodities, improves their artistic taste, and provides materials for art education. Cultural identity and educational content are well-developed. Using the pattern characteristics of the murals in the Mogao Grottoes to improve the educational content can enhance people's sense of cultural identity. Educational institutions can use patterns to integrate them into their own characteristic education, and based on this, they can showcase, protect and inherit traditional Chinese culture, and at the same time, enhance their own educational and cultural connotations. Multi-disciplinary transactional integration. The pattern characteristics of the murals in the Mogao Grottoes can promote the integration of multi-disciplinary education and the continuous development of educational activities. The patterns of the murals in the Mogao Grottoes are characterized by diversity. Students can experience different art spaces and improve their artistic imagination by learning and appreciating the murals of the Mogao Grottoes (Ma et al., 2023). Moreover, the murals of the Mogao Grottoes, which have different styles and themes and various expressions, can also show students various artistic possibilities to stimulate the tolerance of students' artistic creations and improve the diversity of their artistic creations. Based on the understanding and appreciation of the various patterns and forms of the murals in the Mogao Grottoes, students will also jump out of the traditional framework from their personal creations, and bravely try different forms of artistic expression to improve the artistry of their personal style.

Strengthen the Cultivation of Students' Aesthetic Taste and Creative Ability

The murals of the Mogao Grottoes have a variety of motifs, such as different geometric figures and natural elements, religion, and mythological stories. The introduction of the motif in mural elements in aesthetic education will broaden students' artistic horizons and provide them with an aesthetic experience of art from various cultural backgrounds—secondly, the cultivation of creative thinking. The characteristic patterns and color combinations in the murals of the Mogao Grottoes allow students to find a lot of unique creative materials. In their artistic practice, they can integrate elements of Mogao Grottoes' mural patterns into their creations and combine their creativity to develop innovative thinking—secondly, cultural inheritance and understanding (Shui et al., 2022). Through the study and application of the pattern characteristics of the Mogao Grottoes murals, students can not only understand classical Chinese art and culture but also understand the lifestyles and ideas of the ancients in various historical stages to deepen people's recognition and understanding of the cultural heritage value of the Mogao Grottoes murals. Finally, technical skills are upgraded. In the process of imitating, reinterpreting, and interpreting the mural patterns of the Mogao Grottoes, students will be exposed to many painting techniques and how to use materials. It can help students conduct technical training and improve their artistic innovation and practical ability. Stimulate students' innovative thinking. The unique and diverse pattern characteristics of the Mogao Grottoes murals can stimulate students' innovative thinking and encourage students to constantly try different expressions and creativity in their creations (Song, 2023). First of all, the patterns of the Mogao Grottoes murals are unique, and the basis for the formation of the uniqueness is that the pattern education of the Mogao Grottoes murals often adopts different themes of multiple cultural systems and a variety of Chinese and foreign art techniques. Students can be inspired to combine traditional themes with modern elements and develop new and creative forms of artistic expression. Moreover, when learning and appreciating the mural works of Mogao Grottoes, students can also learn how to improve the visual impact and aesthetic shock of their works when appreciating various artistic styles and techniques to continuously explore and try different painting techniques, color application methods, composition methods, etc. in their own creations (Sun et al., 2022).

Diversify Arts Education

The effective introduction and application of the characteristics of the mural patterns of the Mogao Grottoes in art education can achieve certain value. First of all, improve the diversity of students' aesthetic literacy. By learning and appreciating the pattern characteristics of the murals in the Mogao Grottoes, students can improve their aesthetic literacy and improve their understanding and awareness of various artistic styles and expressions.

First of all, the Mogao Grottoes' murals are rich in content, including various themes such as Buddhist stories, myths and legends, historical figures, etc. The existence of the murals of the Mogao Grottoes has become a historical witness. When learning the murals of the Mogao Grottoes, students can not only appreciate the exquisite artistic modeling and bright color matching skills (Xu, Zhang, & Wu, 2023), but also understand the historical stories behind the patterns so as to understand the living conditions, religious beliefs, and aesthetic pursuits of the ancients. Aesthetic experience can greatly enrich students' aesthetic experience and improve their aesthetic perception ability. Secondly, by enriching the diversified connotation of students in the process of learning and appreciating the murals of Mogao Grottoes and analyzing their pattern characteristics, students can be exposed to various historical stages and regional styles of pattern art and expression. From the Northern Wei Dynasty to the Tang Dynasty, Song and Yuan dynasties, the patterns of the murals in the Mogao Grottoes have different styles (Yin et al., 2021), which can reflect the aesthetic exploration and understanding of artists in various periods. Through the analysis and summary of various styles and techniques, students can feel the richness and impact of the visual experience, and understand the charm of the works of the Mogao Grottoes murals at different stages. At the same time, learning and appreciating the pattern characteristics of the murals in the Mogao Grottoes can enable students to understand the aesthetic concepts of ancient artists in various periods, the social environment at that time (Yin et al., 2022), and the correlation between different cultural backgrounds. In addition, students can emotionally experience the charm of works of art from thousands of years ago. In this way, students' aesthetic and critical thinking skills can be improved, and their creative thinking can be improved. By increasing the diversity of teaching practices, students can improve their artistic practice and their personal innovation ability in imitating the mural patterns of the Mogao Grottoes. Through the analysis and discussion of the characteristics and expressions of the Mogao Grottoes, they can cultivate their artistic aesthetic ability and creativity, as well as their interdisciplinary learning and practice ability. In short, introducing Mogao Grottoes mural patterns into the curriculum to carry out interdisciplinary learning can match the boundaries of various traditional disciplines, promote the mutual penetration of knowledge of various subjects, and cultivate students' comprehensive quality and innovation ability. In this way, students' knowledge systems can be enriched, and their innovative spirit and cross-border thinking ability can be cultivated. Fourth, innovate teaching methods. By analyzing and studying the pattern characteristics of the murals in the Mogao Grottoes, teachers will innovate their own teaching methods, such as case studies or group discussions, to make teaching more exciting and vivid so as to attract students. For example, the teacher can select a case study from the pattern of the Mogao Grottoes mural so that the students can make an in-depth analysis. Based on students' understanding of the historical background of the pattern, painting style, related techniques, and subject matter, students are guided to think seriously about the cultural and artistic connotations and related artistic skills behind the artworks. Based on this, students' creative associations can be stimulated, and their ability to appreciate art can be cultivated.

Enhance the Sense of Identity with Traditional Culture

Students can deepen their understanding of traditional Chinese culture and history by learning and appreciating the patterns of the Mogao Grottoes, enhancing their self-confidence in their own national culture, and improving their sense of cultural identity. Based on this, students can deepen their understanding of the overall appearance of ancient Chinese society, understand traditional Chinese culture and religious beliefs through studying Mogao Grottoes, and then enhance their national cultural identity. Secondly, in the Mogao Grottoes mural patterns, there are many Buddhist motifs, social life patterns, historical legends, etc. The subject content constitutes the traditional cultural content of the Chinese nation. Students can learn the Mogao Grottoes mural patterns to know and understand the ancient Chinese society, religion, history, culture, etc., and in the process, feel the aesthetic pursuit and artistic expression of ancient Chinese artists. Based on this, it can also enhance their sense of identity with the Chinese nation's artistic tradition and improve their self-confidence. In imitating the mural patterns of the Mogao Grottoes, students can improve their artistic practice skills, such as improving their observation skills, depiction skills, and composition skills. First of all, students will improve their observation skills and depiction skills. The lines of the Mogao Grottoes mural patterns are excellent, the colors are vibrant, and the style is extremely unique. If students can deepen their observation of the Mogao Grottoes mural patterns, they can improve their ability to practice their art. For example, they can imitate the character shapes, costume textures, and scenery layouts in the Mogao Grottoes mural patterns, learn and exercise their ability to capture details, improve their hand coordination, and then interpret the original appearance of the pattern more accurately in the depiction (Zhang et al., 2022). Secondly, imitating the mural patterns of the Mogao Grottoes can also improve students' artistic perception ability and teach them how to express unique light and shadow effects through the clever use of lines and colors, creating a three-dimensional effect, which has a very positive impact on improving their painting skills. Then, it strengthens students' sense of composition and creative ability. Students can refer to and imitate the motifs of the Mogao Grottoes murals to develop their artistic creations (Zhang et al., 2022), and in the process, they need to understand the storyline and cultural connotations behind the motifs.

Based on this, students will develop an ability to understand composition, and learn to pay attention to the relevance of the overall layout and theme expression when composing, and then improve their personal creative skills, such as improving their ability to control various aspects of spatial distribution and visual intersection and visual flow in creation. In addition, in the combination of imitation and creation, students can also try to use traditional elements for their own works to improve their personal comprehensive artistic practice ability and innovation ability.

Optimize the Content of Modern Art Education

The study of the pattern characteristics of the murals in the Mogao Grottoes can impact the creation of modern graphic art. First, strengthen cultural inheritance education. As one of the treasures of traditional Chinese art, the motifs of the Mogao Grottoes are a key component, and their effective introduction in the curriculum can enhance students' understanding of the Mogao Grottoes murals, enhance their cultural vision and their determination to preserve cultural heritage. For example, by allowing students to learn about the Buddhist stories in the murals of the Mogao Grottoes, they can understand the spread of Buddhism in ancient China and the profound influence of Buddhism on Chinese culture. For example, students can develop their aesthetic ability based on the study of various artistic techniques such as the colors and lines of the mural patterns in the Mogao Grottoes. In addition, it enhances cultural self-confidence. Understanding, recognizing, and mastering the essence of the nation's culture is the key to enhancing students' national self-confidence and pride. Integrating the characteristics of the mural patterns of the Mogao Grottoes into students' learning can stimulate students' sense of responsibility for the protection and inheritance of the cultural heritage of the Chinese nation. In this way, it will enhance their ability to act and promote the protection, inheritance, and promotion of the cultural heritage of the Chinese nation. As we all know, the Mogao Grottoes' mural patterns cover a wide range of fields, such as art, religion, and history. Introducing the teaching of mural patterns in the Mogao Grottoes curriculum can increase the content of interdisciplinary learning and broaden students' artistic knowledge horizons and depth of knowledge in all aspects (Zhang et al., 2022)—for example, the fusion of art and history. The murals' painting style and subject matter in the Mogao Grottoes carry much historical information. By learning the characteristics of the Mogao Grottoes mural patterns and related techniques, students will learn to appreciate the Mogao Grottoes mural patterns and understand the social, political, economic, and cultural changes and developments in various periods of ancient China, thereby broadening their understanding of history. For example, to explore religious cultures. The murals of the Mogao Grottoes contain many works related to Buddhist themes, classic Buddhist stories, and traditional Chinese elements. When interpreting the religious themes in the murals of the Mogao Grottoes, students can deeply understand the role of Buddhist culture in transmission and development in ancient China and broaden their understanding of the diversity of religious cultures.

CONCLUSION

Through the study of the intangible inheritance of the characteristics of the mural patterns in the Mogao Grottoes and the educational value of the pattern art, this paper concludes that the dyes used in the representative works of Feitian, Thousand Buddhas and Nine-colored Deer in the Mogao Grottoes in Dunhuang are Pb_3O_4 , Fe_2O_3 , Huangdan, Orpiment, Realgar, Fe_3O_4 , $AlSiO_4$, $CuCO_3 \cdot Cu(OH)_2$ and $AlSiO_4$ are dominant, and Fe_2O_3 , $AlSiO_4$ and $CuCO_3 \cdot Cu(OH)_2$ dye comes from Europe, indicating that China has frequent dye trade with Europe. Moreover, the shape of the Thousand Buddhas and the Flying Sky is dominated by the Yangtze River Delta and the oval, similar to the shape of the Buddhist relics, indicating frequent Buddhist cultural exchanges between China and Central Asia. In addition, a thick protective layer is formed on the surface of the murals, mainly made of oxides such as FeO , PbO , AlO , and CuO , and the protective layer plays a role in the dry and hot environment, which also fully illustrates the wisdom of ancient Chinese painters and preserves the Dunhuang murals more completely. In the process of research, due to the limitations of instruments, equipment, and samples, it is not possible to conduct more accurate research, so the results are only used as practical theoretical references and enrich related concepts. In the future, more data and documents will be collected to improve the integrity and comprehensiveness of the data, and the corresponding problems will be analyzed from a multi-dimensional perspective to improve the feasibility of this study.

Through the Dunhuang murals, it can be seen that the flying sky, the nine-colored deer and the thousand Buddhas are relatively complete contents, and their colors and shapes have high artistic value, reflecting the trade relations and cultural exchanges between ancient China and Europe, Central Asia and other regions, and also reflecting the cultural connotation of ancient China, providing support for the content optimization and cultural precipitation of modern art education. However, there are some limitations in this study, which mainly reflect the aspects of non-damage measurement and data analysis, and continuous data collection will be carried out in the future to make up for the above shortcomings. There are certain limitations in the research in this paper, which

are mainly reflected in the long time period and wide coverage of Dunhuang murals, so it cannot be fully explained and elaborated. Although this article selects representative works such as Thousand Buddhas and Flying Heavens, the works still cannot comprehensively summarize the Dunhuang murals. Therefore, in the future, we will focus on expanding the number of samples and deeply analyzing the content and value of Dunhuang murals.

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