

DUNHUANG MOGAO CAVES IMPACT ON ADOLESCENT CULTURAL HERITAGE EDUCATION WITH NEW MEDIA—A CASE STUDY ON *THE DEER AND THE SNITCH*

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ABSTRACT:

As a key role in reflecting local diversity and identity, cultural heritage is of significant value to the living and well-being of a region and its people. Additionally, cultural heritage education serves to further enrich the values, core literacy, and cultural identity of future decision-makers. Even though countries are paying increased attention to these various aspects of education and research on cultural heritage obstacles to engagement exist. The obstacles addressed here include passive or minimal participation, and the lack of research surrounding methods for engaging adolescents with cultural heritage. However, the Dunhuang Academy's animated short, *The Deer and the Snitch*, featured on WeChat's mini-programs, presents an example of novel methods used to educate and engage the adolescent demographic with cultural heritage through new media technology. Set in the Dunhuang Mogao Caves, the world's oldest, richest, and most exquisite site for Buddhist art, this animated drama breathes life into the Dunhuang frescoes through its professional use of new media technology and strengthens their philosophical themes of truth, kindness, and beauty. With increased accessibility due to the mobile nature of WeChat mini programs, combined with an integrated mechanism for viewer participation, this animated drama constructs a bridge between individuals and cultural heritage. The planning and production ideas behind *The Deer and the Snitch* provide an innovative perspective for the use of new media technology in cultural heritage education.

1. INTRODUCTION

By 2021, China's total number of world heritage sites reached 56, ranking second in the world. The Dunhuang Mogao Caves date back to 366 A.D. with a total length of more than 1,600 meters, it contains 735 caves of which 492 contain 45,000 square meters of frescoes and approximately 2,400 stucco statues. It is the largest existing Buddhist grotto temple in China and is also the oldest, richest, and most exquisite site displaying Buddhist art in the world. It represents the pinnacle of Chinese Buddhist art between the 4th and 14th centuries, and it served as an important witness to the exchange and integration of Chinese and Western cultures.

In 1987, the Mogao Caves were approved by UNESCO to be included in the World Cultural Heritage List. The site's historical, artistic, scientific, and technological value reflects the wisdom of people across different nationalities and eras while also showing the vitality of the nation. The Mogao Caves constitute both tangible and intangible characteristics of significant cultural heritage site and play an important role in recording the development and evolution of science, technology, and art in China. Additionally, the Mogao Caves represent a place that encourages the establishment of a shared cultural history and identity.

The research subject of this paper is the story of *The Nine-colored Deer* in Cave 257, which is one of the most complete and representative frescoes among similar works in Dunhuang. The fresco, painted during the Northern Wei Dynasty, remains well-preserved to this day and tells a story of kindness and truth. Furthermore, it records the historical introduction of Buddhist art into China and its integration with traditional Chinese culture. Because of the vicissitudes in its plot, ingenious design, and vivid and harmonious imagery, this fresco in particular has become representational of constructed

values of truth, kindness, and beauty of the culture of China. Based on these features, the story of the Nine-colored Deer has not only been selected for Chinese textbooks but has also been selected by many artists as a topic for transformative works, extending to animated films, ballet, and other artistic works.

As a key field in today's intellectual society, the "knowledge" and "creativity" extended by cultural heritage cannot be ignored. In 1998, the Committee of Cultural Heritage Education emphasized the importance of cultural heritage education and stated that educational activities within this field give meaning to the construction of an ideal future by strengthening the understanding of the past (Ott and Pozzi., 2008). One of the most important forces in the protection of cultural heritage is the youth (Jaafar et al., 2015). In 2004, the World Heritage Committee listed the adolescent as a priority on its agenda and declared that the future of world cultural heritage is in their hands, as they are future decision-makers. Therefore, cultural heritage education for adolescents not only benefits sustainable cultural heritage development but also enriches the youth's values and comprehensive development through cultural identity, cultural understanding, core literacy, and humanity. However, despite the considerable time spent advocating for adolescent participation, compared with adults, adequate investment in pedagogical research has not been taken (Wang et al., 2017).

Many scholars have explored various methods and effects of cultural heritage education. At the same time, digital and communication technology have gradually become another hot topic as a means for modernization to meet the challenges of today. Jagielska-Burduk et al., (2021) state that, in this challenging era, various initiatives in the field of cultural heritage have been transferred onto the Internet, and this digital

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migration has increased the visibility and access to cultural heritage. Digital methods for educational activities remove physical and temporal barriers for users thereby making engagement with cultural heritage more accessible. Although the challenges and opportunities faced by cultural heritage education in the post-pandemic era deserve further research and analysis, it can be safely assumed that online education measures will be a part of the "new norm" (Jagielska-Burduk, 2021). Even in the face of challenges, practical application such as XR, ICT, and digital technology based on the convergence media platform plays a positive role in cultural heritage education, protection, and sustainable development. However, despite a wealth of experience regarding digital practices, document analysis indicates that the research on education on Chinese cultural heritage still focuses on curriculum development and methodology exploration under traditional pedagogy.

In response to the gap in research, this paper will outline and analyze the methods and effects of cultural heritage education in China and abroad through the method of literature research and explore the main factors that affect cultural heritage education and the subsequent learning experience of adolescents. With the spiritual, cultural, and aesthetic value inherent within *the nine-colored deer* and the animated drama, *The Deer and The Snitch*, produced by the Dunhuang Academy as a case study, this paper analyzes how to extract and transform the value of Dunhuang culture through digital technology, and how digital cultural products created with new media technology affect the cultural heritage education of adolescents.

2. METHODS AND METHODOLOGY

This paper implements the methodologies of literature review and case study in an effort to present a comprehensive view of the topic. Firstly, researchers will explore the key points and issues in cultural heritage education by analyzing literature and relevant theories in the fields of psychology, pedagogy, and museum science.

For filling the gap in research found in the literature review, the researcher will utilize a case study demonstrating the potential for engagement with cultural heritage through digital media. The recent implementation of an interactive digital platform in Dunhuang provides a fruitful subject of analysis. *Traveling in Dunhuang* was launched by the Dunhuang Academy in April 2020. By the end of 2020, the entire network achieved a total of 37 million views and was dubbed by 140,000 users (see Figure 1). As the premiere story, *The Deer and the Snitch*, based on the fresco, *The Nine-colored Deer*, in Cave 257 (see Figure 2), the development team utilized innovative design and meticulous production in accordance with crossover integration trends to combine the cultural value of Dunhuang with digital interactive technology and digital animation technology. The interactive animation presents the caves in the palm of one's hand and integrates novel interactive dubbing. Therefore, this study will select this work as a case study to conduct a dynamic analysis for the issues proposed in this research paper.

While *Traveling in Dunhuang* provides the user the opportunity to explore a wide variety of places this study has chosen to focus on one. The Nine-colored Deer fresco in the Dunhuang Caves was chosen for its iconic symbol of Dunhuang, the clarity in storytelling, the successful preservation of the fresco, and the fruitfulness of the research. More importantly, the relatability of the depicted story's themes

of truth, kindness, and beauty is in line with values advocated by Chinese culture and the international community.



Figure 1. Left: *Traveling in Dunhuang* Mini Program.

Middle: *Traveling in Dunhuang* Animation.

Right: *The Deer and the Snitch*.



Figure 2. Mogao Grotto, Cave 257 "The Nine-colored Deer"
Northern Wei.

3. DISCUSSION AND ANALYSIS

3.1 Issues and Key Points in Adolescent Cultural Heritage Education

Cultural heritage education is an integral means for personal education, sustainable development, and the establishment of national identity. Besides, such education also serves as a medium and long-term goal by developing flexible and interdisciplinary paths, improving the learning process and research skills, and enriching interpersonal communication skills. The formulation of this new education path plays a decisive role in cultivating future professionals (Achille and Fiorillo, 2022, p. 2566). According to Achille and Fiorillo (2022, p.2566), three elements cannot be ignored in the process of cultural heritage education: communication with cultural subjects and citizens, research and training, and local collaboration, and the objectives within this field can be summarized as accessibility, communication, and participation. Policy and strategic evaluation can provide researchers with a general reference framework. Therefore, a single program can also become a direct contribution to a wide range of systems. Moreover, this reference framework can also be regarded as an evaluation standard to review traditional or non-traditional education methods and training programs and propose practices or theories suitable for the current environment and needs to deal with this complex topic.

3.1.1 Inadequate Training and Passive Participation of Educators: While the importance of cultural heritage is widely recognized, the standard is also determined by the decision-making power of participants and decision-makers in its production process, which is more explicit in cultural heritage

education activities. With the diversification of education methods, educators are beginning to play an increasingly important role. Differences in attitude and professionalism bring into question whether pedagogy achieves the desired effect. Research from Pérez et al. (2010, p.1327) indicates that primary school educators lack sufficient understanding of cultural heritage concepts, relevant procedures, and professional knowledge, which are specifically manifested in the inability to answer or deal with thematic questions in the classroom. Conversely, middle school educators enjoy cultural heritage education and its concepts, but there are shortcomings in teaching methods. In China, a leading factor for the poor promotion of cultural heritage education is also due to educators lacking knowledge of cultural heritage and relevant experience (Li, 2018). After conducting research in France, Loison (2006) reached a similar conclusion and outlined four major issues, namely: epistemological, didactic, pedagogical, and material. It is worth noting that this kind of phenomenon occurs not only in traditional classroom teaching methods. According to Stolare et al. (2021), Sweden's primary school educators integrated field trips to cultural heritage sites and historical buildings into their curriculum. However, many educators stated that they would not take full organizational and substantive responsibilities in guiding students. Thus, passive participation from educators, in addition to the lack of systematic understanding and professional training constitute root causes for difficulties in engaging in or receiving cultural heritage education.

Cultural heritage education involves comprehensive knowledge, from the technical level to the social and cultural levels produced by the heritage itself, to the awareness level involved in the ideological and moral development of adolescents (Achille and Fiorillo, 2022, p. 2566). The formation of awareness in adolescents is comprised of cognition, emotion, and action. Adolescents must undergo the gradual process of character awakening, identification, and strengthening. Schools, families, universities, governments, and non-governmental organizations, as adjacent groups that affect adolescent learning and protection of cultural heritage, work independently in most cases (Wang et al., 2017). The youth's cultural heritage education cannot be regarded as a task for any single group. The attitude and professional degree of educators toward cultural heritage not only affect whether adolescents can receive complete and accurate information at the knowledge and technological level. The collaboration of heritage managers (both formally and informally) also has a significant impact on the awakening, development, and cultural identity of adolescents. Furthermore, if heritage professionals and educators can view cultural heritage from a dynamic perspective, combined with the knowledge and ability of historical thinking and reasoning, they may also lead students to achieve an enhanced historical understanding and cultivate critical historical thinking—a concept also advocated in the field of history education (van Boxtel et al., 2016, p.13).

3.1.2 Low Participation and Lack of Knowledge Construction: The general sense of constructivism is that it is a theory of learning or meaning-making, that individuals create new understandings based on interactions between what they already think they know and believe and ideas and knowledge with which they come into contact (Resnick, 1989). Constructive and collaborative factors are also considered the characteristics of meaningful learning (Karppinen, 2005). Constructivism learning theory enables learners to participate in the process of value formation, thus promoting deep learning and understanding (Eirini, 2015). Simultaneously, constructive

learning can stimulate critical thinking in students, as Santisteban-Fernández et al. (2020) stated. Another value of heritage education is to cultivate adolescents' critical awareness so that they can reinterpret culture according to their situation and interests. However, even though constructivist teaching is becoming increasingly popular in countries and economies founded in Confucian heritage cultures (i.e., China, Korea, Singapore, and Malaysia), their teaching is still regarded as passive and teacher-led, so it cannot maximize the enthusiasm and creativity of students, nor can it cultivate self-reflective autonomous learners in an innovation-driven and fast-changing world (Thanh, 2016, p.283-284).

Li (2018) found that, in a study of adolescent students' cultural heritage education in a traditional classroom environment, low participation opportunities are also one of the problems existing in this education process. As museums and other cultural institutions continue to redefine their roles, the concept of public participation, sharing, interaction, cultural entertainment, and participatory design are no longer as uncommon (Radice, 2014, p.1). Researchers and institutional managers have gradually increased the importance of audience participation in cultural heritage. Active participation in cultural activities can strengthen the experience of audiences and learners, thus responding to the new expectations of contemporary audiences. Learning is an active process of constructing rather than acquiring knowledge, and instruction is a process of supporting that construction rather than communicating knowledge. (Duffy and Cunningham, 1996, p. 171). Low participation opportunities and lack of constructive and creative teaching will lead to the students' inability to actively gain knowledge and motivation satisfaction from learning, as well as affect the ability of educators to assess their student's learning effectiveness.

3.1.3 Lack of interest guidance: Early adolescence is a time of burgeoning independence, autonomy, and focus on peers, and it is also a time when individual interests, skills, and preferences become salient to young people (Quinn, 1999, p.96). During this period, the objective of tapping into the interests and potential of adolescents is to create conditions for the collision of individual needs and development opportunities. However, Dewey (1913, pp.2.8) states that the main difficulty of the school was that it did not fully mobilize the students. From a psychological perspective, activities that do not raise interest cannot be carried out effectively. When students think learning is a task, they can only be fully engaged under compulsion. Whenever there is external interference, their attention will be released from its bond. Therefore, the significance of interest in cultural heritage education is also worth considering—how cultural heritage, historical sites, and the accompanying narrative can stimulate students' interest in history and promote the formation of knowledge and abilities (van Boxtel et al., 2016). Additionally, what strategies or models should cultural institutions and cultural workers implement to integrate students' interests with established content? As the starting point of understanding history and establishing a conscious identity, historical interest can stimulate an individual's need to experience traces of history. Only by unlocking this desire for knowledge and combining traditional or non-traditional teaching models and methods, at the same time collaborating with objects and media in the environment can the needs of guided interest be met. Consequently, the link between modern individuals and the past will be re-established. Besides, according to Chan et al. (2018), interest-driven creative activities help students form

learning habits in daily activities and produce more lasting results.

3.2 Value Transformation of Mogao Caves in *The Deer and the Snitch*

3.2.1 Art Preservation Through Technological Means and Visual Design: The images used in the animation production are high-fidelity digital fresco archives, with an image acquisition resolution of 300 DPI, a single image overlap of 50% between two adjacent images, and 2mm image positioning correction accuracy. The resolution of the displayed image is more than 4000*4000, and the resolution of the image used for research purposes can reach 8000*8000. In general, using the acquisition method of fresco all-around coverage, the distance between the digital camera's movement and the wall is precisely controlled to ensure the accuracy of the fresco image data. Overlapping acquisition through the constant movement of the orthophoto allows for more evenly illuminated images while reducing deformation. Point cloud image positioning is used to correct the spliced image to achieve millimeter-level splicing accuracy and control the error value. Finally, the fresco collection data are sequentially added and arranged by the "cross" stitching method, and only the most fidelity and almost deformation-free middle part of each image are selected and presented as the final digital archive. Based on this, the key materials in the digital frescoes were extracted, reorganized, color-corrected, and the backgrounds and images were painted with Adobe Photoshop, and dynamic effects were created with Adobe After Effects to shape the typical environment and render the texture of the images.

Unlike most animation productions, the visual design of *The Deer and the Snitch* retains the quality of the original fresco and recreates the texture as much as possible through visual design. Additionally, the team maintains the national folk style of "wire-stroke" art primarily used in frescos during the Northern Wei Dynasty, which consists of lines to shape images (see Figure 3). This art form has a different expressive style when depicting objects, such as animals, people, landscapes, buildings, etc. In terms of color, the Dunhuang frescoes of the Northern Wei Dynasty are influenced by paintings from western regions, conveying warm, rich, and vivid colors combined with green, cyan, black, and white interspersed throughout the story, neutralizing the solemn sense brought by ochre red (Wang, 2021, p.9) In general, the shape is simple, the color is calm, and the texture is strong.

Besides, the visual effects in *The Deer and the Snitch* show the original appearance of the fresco to the greatest extent. Based on the opinions of art experts, incomplete portions of the apparently incomplete portions are rigorously restored according to science, to maximize the integrity of the picture and enhance the audience's perception (see Figure 4). Subtle scars and damages have been preserved, maintaining the primitive texture and historical sense of the fresco.



Figure 3. Left: Design of the Nine-colored Deer in the 1981 animation.

Right: Design of the Nine-colored Deer in "*The Deer and the Snitch*".



Figure 4. Comparison between the original fresco and the recreated animation.

The Nine-colored Deer is a horizontal comic strip, a style that was historically prominent in Chinese paintings. The wide scroll composition of this piece lends itself to a unique narrative charm. Due to the large discrepancy between the ratio of its height and width, the painting has a compressed depth of field and presents a horizontal flow in the visual continuity. In *The Deer and the Snitch*, the flow of the entire painting, as well as the enlargement and reduction of a particular point largely restore the audience's tendency when viewing the physical fresco, thereby enhancing the narrative sense and fluidity between the images. In addition, specific scenes are separated through editing, virtualizing, reorganizing, and resizing the scene elements. The vertical depth of the mountains and buildings is emphasized to stagger the scenes in a more orderly fashion. This design reflects the aesthetics of Chinese painting and, in doing so, strengthens the depth of field and balances figures within the painting for a realistic three-dimensional and spatial effect.

It is worth mentioning that it is difficult to breathe life into the static figures within the fresco. The re-creation needs to ensure quality while also respecting the content of the original painting and matching the overall theme to make the picture more lifelike. Based on the original fresco, *The Deer and the Snitch* has made very subtle adjustments to the colors, expressions, and forms of the characters to bring them and their emotions to life. For example, in the last scene, when the Nine-colored Deer calmly conveys the truth to the king, he looks back and berates the snitch for his behavior. The expression of the drowning man changes from duplicitous to panic. His posture changes from leaning forward and pointing the deer out

to a half-kneeling posture covering his chest and legs. The adjustment in his eyebrows and mouth, although subtle, achieves a dramatic effect. Combined with the rapid flashing of warm and cool colors, it helps the audience feel the weight behind the drowning man's deplorable actions from sound and sight alone (see Figure 5).



Figure 5. Comparison between the original painting and the animation.

3.2.2 Music and Dubbing to Enhance the Experience:

Using music to emphasize the plot and draw a connection between selected visual events, this type of interactive audio-visual method has a significant effect on the process of meaningful creation. As an important element for connecting products and emotions, music can emphasize explicit or implicit context in visual media and highlight the central statement of the whole (Kalinak, 1992). The Dunhuang region has played a pivotal role in the cultural exchange between China and the West along the Silk Road. It contains different nationalities, countries, and religions converge, which has shaped its unique population and cultural form (Xi, 2016). The music and plot in the animated drama, *The Deer and the Snitch* faithfully integrate Dunhuang characteristics while also considering the accessibility of the content. Therefore, an overtly religious musical style was avoided. Instead, the integration of classical Chinese instruments and electronic music creates a far more diversified style, enhancing the appeal and optimizing the overall auditory experience. In general, musical composition can be divided into two parts according to style and instrumentation. The main instruments featured in the first piece of music are string instruments, such as the zither, pipa, erhu, and wind instruments, such as the alto and soprano sheng, bamboo flute, etc., to create a soothing throughline between the melody and narration. The second piece of music mainly uses percussion instruments, such as chimes and drums, to create an air of mystery with the change of pitch, timbre, and rhythm. Through the use of music, the story has an enriched sense of inspiration and space and adds a layer of mystery with low, minimalistic notes of color.

Furthermore, to provide the audience with a more immersive auditory experience to accurately grasp the individual aspects of each character, *The Deer and the Snitch* specially invited the Shanghai Film Dubbing Studio to interpret the characters. Dubbing techniques, tone color, emotional control, vocal rhythm, and the understanding and expression of visual narration, plot, and target dialogue from voice actors affect communication between audio-visual content and the audience to varying degrees. Because *The Nine-color Deer* draws from *The Nine-color Deer Sutra*, the original text is more obscure and difficult to comprehend. To make it easier for the audience

to understand, the narration and dialogue in the story have been edited to make it more approachable.



Figure 6. Left: Select a character to dub. Middle: Press to begin recording. Right: Generate a post to share.

3.3 The Role of Digital Practices in Cultural Heritage Education

3.3.1 Interactive Methods Enhance Participation and Strengthen Connection Between Audiences and Cultural Heritage:

The Deer and the Snitch integrates an interactive participation mechanism in its presentation. Users can choose one or more characters to dub for themselves. Once complete, the mini program will automatically generate a post for the viewer to save and share on social media. The dubbed version can then be viewed by scanning the QR code in the picture (see Figure 6). Eriksson (2007) divides participation into three categories: personal experience, interaction and context. In the animated drama, the story provides users with situational support, giving users an immersive way to experience the animation's charm. Interactive dubbing provides an opportunity to participate, enabling the audience to integrate their own interpretation and furthering viewer immersion. Finally, the generation and sharing of dubbed versions is the effective output of the above interactive behaviors, to gain a sense of control and belonging and strengthen the positive experience.

According to data, by the end of 2020, more than 37 million Dunhuang animated shorts had been played and more than 140,000 people had participated in dubbing. To some extent, this data reflects the audience's enthusiasm for participating in a digital cultural heritage product on a new media platform. Additionally, the QR code on the sharing page generated after user finish dubbing their own version simplifies and accelerates the communication process by exploiting the accessibility and social aspects of the Internet, thereby tapping into potential users and broadening audience participation.

Digitization capabilities provide cultural heritage institutions with a method for recording, management, and dissemination, whereas the process of collecting, recording, interpreting and disseminating "digital heritage" promotes the active participation of the audience (Psomadaki et al., 2019). As a result, this improves the digital capabilities of cultural institutions and cultural creative workers, optimizes the digital infrastructure of multi-disciplinary cultural enterprises, and obtains multi-level support from educational institutions. The collaborative work between all parties helps to form an online

cultural and creative community in which the audience plays the leading role (Psomadaki et al., 2019). Narration, as the core of community identification and cooperation, supports learners' lifelong learning and helps to build and explain an understanding of the world. Narrative design based on cultural environments and new media technology reveals the background behind cultural works of art, supports creation and learning and provides the public with an interesting and educational experience (Mulholland et al., 2020). As some cultural institutions have stated, positive, concrete and multi-sensory experiences can stimulate thinking (van et al., 2016). Digital interaction relies on characteristics, such as diversity and personalization, extending the depth and breadth of cultural heritage without physical or temporal constraints, effectively attracting audience participation, and allowing for re-creation while simultaneously learning the value of cultural heritage. Integrating special mechanisms into the virtual environment, such as more people and more characters for dubbing in the case, post sharing, etc., creates a common experience for learners and strengthens collaborative and personalized learning among individuals, effectively promoting a positive construction between individuals and cultural heritage.

Furthermore, active participation can trigger a flow state in the individual's consciousness through enjoyment (Pace, 2004). This flow state has a positive impact on individual behavior and can improve their subjective well-being (Chen et al., 2000). And this flow state can also stimulate learning motivation, especially for adolescents, as happiness stems from internal satisfaction, that is, the internal reward or interesting experience generated when people engage in an activity. This experience will urge individuals to start or continue an activity because they enjoy their current state of being. Research indicates that the emotional connection established through participation can develop the learning process, which makes individuals more susceptible to understanding exhibitions and heritage sites, thereby stimulating the learning process (Othman et al., 2021). Taking history education as an example, Othman et al. state that the degree of interest and motivation in adolescents while visiting a museum are subject to emotions. If they can interact with the exhibit, museum, or products, this will express an array of emotions, such as excitement, anticipation, curiosity, self-confidence, and/or a sense of achievement. These cognitive and emotional dimensions do not contradict but rather reinforce each other (Savinije and De Bruijn, 2017).

3.3.2 Animation Design Retains Artistic Charm and Enriches Aesthetic Experience: The digital representation of cultural heritage closely correlates to aesthetics, creativity, and auratic quality. According to Benjamin (1936), authenticity is the essence of all things, and the auratic quality of art gradually withers with the era of mechanical reproduction. Because of its general characteristics, digital technology often conflicts with the authenticity emphasized by some scholarly discourse regarding cultural heritage or works of art, but it is still possible to imbue the aura of authenticity into products through digital technology (Jeffrey, 2015). Jeffrey (2015) claims that, digital objects can indeed manifest an auratic quality and that this is in fact fundamental to how they are received by various audiences. Existing digital visualization faces considerable challenges, such as the menial utilization of resources detracting from the audience's aesthetics, perception of authenticity and value acceptance of cultural heritage (Jeffrey, 2015). Whether or not a part of the original object's aura can be transferred to the replica depends on factors that affect the

production quality, such as professional knowledge, intentionality, and resource expenditure (Latour and Lowe, 2011). Although the digital copy is different from the physical copy, it is still affected by the above factors and used for output (Jeffrey, 2015).

In the case of *The Deer and the Snitch*, the intrinsic value of *The Nine-color Deer* was extracted during the topic selection and planning process, thereby strengthening the philosophical concept of truth, kindness, and beauty in terms of intentionality. In terms of visual design, the team restored the texture of the original fresco to the greatest extent, reflecting the static quality on a physical level through dynamic imagery, and demonstrated the aesthetic expression of the Dunhuang fresco art. Furthermore, in order to ensure the transformative value in its authenticity and academic nature, experts participated in the entire planning and production process. Lastly, the team fully mobilized existing resources through the utilization of official digital scans of the Mogao Caves as the foundation while simultaneously providing excellent technical support and artistic integration to transmit the auratic quality of the original fresco to ensure the quality of this animated drama.

Cultural heritage that has traditionally been appreciated has had the values of beauty and goodness and features that relate to tendencies toward features that are beautiful and good (Melanko and Elo, 2000). Education means the continuation of social life, while values and appreciation affect individuals' interpretation of cultural heritage (Heidi, 2012). According to Heidi (2012), aesthetic understanding and cultural heritage comprehension are related in that they are both constructed in cognitive-effective experience and mature understanding should be based on facts and contextual information. "Teenagers are in a formative period, with a keen sensibility on new things, and are more receptive and immersed in digital scene of digital media, their cognition and aesthetic of which are about the healthy growth of them" (Guandong, 2016, p.67). Furthermore, the background music production, dubbing, and art design in the animated drama, *The Deer and the Snitch*, have built a pluralistic, multi-dimensional, audio-visual aesthetic education space, activating the audience's visual and auditory senses. Combined with the mechanism for participation and interaction, the education method of this optimized unilateral didactic aesthetic provides a strong source of entertainment and immersion, thereby becoming easily accepted by learners. By experiencing this product of professional cultural heritage knowledge, supplemented by sophisticated technological support, subtle aesthetic education on the new media platform helps adolescents learn actively and spontaneously in accordance with their own aesthetic tendencies and value judgment system.

3.3.3 Lightweight Platforms Improve Accessibility and Personalize Output Improves Learning Satisfaction: With the promotion of national and individual awareness regarding cultural heritage and adolescent learning development, the accessibility of cultural heritage exists as a reference point in many practices. In this case, with the WeChat mini program as the carrier for animation production, system development utilizes the WeChat MINA framework, WeChat web development tools, and Tencent Cloud. As one of the most popular social media platforms in the world, WeChat's primary user base is located in Asia, with more than 1.309 billion active users per month as of 2018. WeChat mini-program is an application that exists in WeChat without the need to download, which makes it a lightweight application (Wu et al., 2018). Users can open mini-programs by scanning QR codes or

searching in WeChat. According to statistics, WeChat mini-programs have reached over 600 million active users daily. As a social media application, WeChat has strong user connectivity resulting in low promotion costs. Compared with the webpages generated using HTML5, WeChat mini programs operate nearly as fast as the native application. The large user base and easy operation have improved the accessibility of animated dramas, allowing the audience to interact with Dunhuang culture and learn cultural heritage knowledge, regardless of place or time (see figure 7).



Figure 7. QR Code of *Traveling in Dunhuang Animation*.

Finally, the dubbing function in the animation drama is easy to operate, and users can easily generate their own dubbed version, giving them a sense of satisfaction. According to Almqvist et al. (2007), the ability to meet challenges and engage in goal-directed behaviours promotes children's autonomy, and adequate challenges make it easier for them to function in a positive behavioral norm in varied environments and situations. As Csikszentmihalyi (2014) states, the creation of activities can narrow the stimulation field, allowing individuals to focus on the activity itself and try to improve their skills to cope with greater challenges. During this, clear and explicit feedback is gradually generated, resulting in increased enjoyment of the activity. It is worth noting that, the structure of environmental challenges should be measured, excessively difficult challenges may yield overwhelming effects, inducing anxiety in the individual.

4. CONCLUSION

Cultural heritage has valuable historical, artistic, scientific, and technological value. Teaching these values is one of the important responsibilities of educational institutions. The establishment of common values is an integral part of building a healthy social structure. As future decision-makers, cultural heritage education for adolescents can promote the development of goodwill, positive social behavior, and an optimistic view of the world. At the same time, learning about cultural heritage-related knowledge can also help enrich the national identity and foster a deeper understanding of cultural roots, beliefs and community values in adolescents. However, issues remain with existing cultural heritage education, such as the passive participation of educators, lack of professionalism, low participation opportunities and constructiveness, and lack of guided interest.

The digitization of cultural heritage conforms to current development trends, promotes heritage protection, drives cultural transmission, and has become a popular educational tool for the youth. Based on professional cultural heritage

knowledge and excellent visual production, the animated drama, *The Deer and the Snitch*, has retained the texture of Dunhuang frescoes to the greatest extent, thus displaying its aesthetic expression, traditional Chinese culture and values, as well as subtly fostering the ability of adolescents to recognize, create, experience and appreciate beauty. In addition, the integration of dubbing and sharing mechanisms strengthens audience participation, stimulating adolescents' interest and initiative to learn and understand Dunhuang culture, and it enriches the experience and exploration path, effectively tapping into a broader user base for cultural heritage education through strengthened emotional and practical experience. Finally, the accessibility of cultural heritage education has been improved by relying on the diversity, lightweight nature, and personalized characteristics of digital interactions. In general, *The Deer and the Snitch* is a relatively high-quality example of adolescent cultural heritage education. Through this analysis, the design and development of digital cultural products should first consider the value of drawing from cultural heritage elements, produce art synthesis on the premise of ensuring academic quality, establish a participation mechanism, and select an appropriate communication platform, so as to bring more innovative methods and content.

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