



# Investigation into the Application of AR Manga for the Inheritance and Innovative Education of Martial Arts Culture

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## Abstract

This paper explores the application of augmented reality (AR) technology combined with comics in the inheritance and innovative teaching of martial arts culture. By analyzing the characteristics, advantages, and challenges faced by AR comics, the study expounds on the role of comics in stimulating learning interest and enhancing teaching effectiveness, and proposes several application strategies and methods. The research finds that AR comics offer new opportunities and methods for inheritance and innovative teaching of martial arts culture, presenting broad application prospects.

## Subject Areas

Cultural Heritage, Educational Innovation, Technical Application

## Keywords

Dilemmas in Martial Arts Development, AR Animation, Inheritance of Martial Arts Culture, Innovative Opportunity, Cultural Communication

## 1. Introduction

At present, the development of martial arts is facing many serious difficulties. The loss of traditional authenticity, coupled with limited transmission methods and the absence of dissemination agents [1], has placed martial arts in a challenging position. At the same time, the martial arts industry is still in its infancy, and there are problems such as poor institutional mechanisms, inconsistent norms and standards, and insufficient supply of products and services. In this context, augmented reality (AR), as a new form of creative expression, provides a new opportunity for the innovative inheritance and exploratory development of martial arts culture [2].

It can attract a wider audience, especially the younger generation, with a unique visual presentation and interactive experience, thus effectively alleviating the current dilemma of martial arts development. By skillfully integrating martial arts elements into the creation of AR national cartoons, it can not only vividly show the charm of martial arts but also promote the inheritance and innovation of martial arts culture with the help of modern scientific and technological means and inject new vitality into its development in the new era. Solving these problems is of great significance to the inheritance and development of martial arts culture, and it is also a key task that we need to overcome at present.

For now, the number of people practicing martial arts in China is gradually decreasing, especially the young people's interest in martial arts is not high, resulting in the risk of talent disconnection in the inheritance of martial arts. At the same time, some traditional martial arts schools and inheritance methods have been impacted, and some martial arts halls, boxing clubs and other inheritance institutions find it difficult to maintain their operations due to problems such as funds and venues, which have affected the systematic inheritance of martial arts. Although competitive martial arts have made certain achievements in international competitions, it pays too much attention to competitiveness in the development process and ignores the cultural connotation and technical essence of traditional martial arts to a certain extent. Folk martial arts, on the other hand, are facing problems such as a lack of standardized management and insufficient promotion.

However, the state has issued a series of policies to support the development of martial arts, such as including martial arts in the scope of sports high school entrance examinations, holding various martial arts competitions and activities, etc., to improve the influence of martial arts in society. From an international point of view, the spread of martial arts around the world is becoming more and more extensive, and more and more countries and regions have begun to contact and learn martial arts, but many people's understandings of martial arts are still on the surface, and they have not been able to deeply appreciate its cultural connotation and spiritual value [3]. Although the process of martial arts entering the Olympic Games has achieved some phased results, it still faces many challenges such as rulemaking, popularization of events, and cultural differences. But, through the holding of international martial arts competitions, academic exchanges and other activities, the exchanges and cooperation between martial arts enthusiasts from various countries have become more and more frequent, which has promoted the spread and development of martial arts in the world [4] [5].

## **2. The Needs of Inheritance and Innovative Teaching of Martial Arts Culture**

It explores how to effectively pass down and develop martial arts culture through innovative teaching methods in the contemporary societal context. It analyzes the challenges traditional martial arts face, such as cultural shocks during moderni-

zation (The change of values; the diversification of entertainment methods; the impact of cultural globalization) and the lack of interest among younger generations. They propose a series of innovative teaching strategies aimed at sparking students' interest in martial arts, enhancing their cultural identity, and incorporating modern technological means to improve teaching effectiveness, thereby promoting the sustainable development of martial arts culture. The Mogao Grottoes in Dunhuang, having withstood the ravages of time for millennia, have suffered significant damage in parts. However, with the aid of Virtual Reality (VR), Augmented Reality (AR), and Interactive Reality technologies, based on historical records and archaeological discoveries, they have been meticulously restored. By wearing VR glasses or using AR devices, visitors can traverse time and space, immersing themselves in the historical scenery and cultural heritage of the grottoes, thereby promoting the inheritance and promotion of traditional culture.

### **2.1. The Value of Martial Arts Culture and Its Current Inheritance Status**

The philosophical bases and forms of martial arts are diverse, generally rooted in the wisdom that stresses harmony, self-discipline, and perseverance [3]. Martial arts can build up the body, refine sentiments, shape our character, train our thinking, and express our cultural heritage [6]. Tai Chi is suitable for people of many ages and conduces the body [7] [8]. Beginners have to start learning basic skills, such as horse stance. As their skills are tempered, the complexity and difficulty of martial arts skills gradually rise. With the increase in training difficulty, quite a number of people can't stick to practicing martial arts, and their love for it is also easy to fade with the passage of time. Besides, a large number of people are not keen on learning martial arts and lack enthusiasm. Since ancient times, the unique teaching method of martial arts has been "teaching through words and deeds"—a combination of verbal explanation and physical demonstration, which has remained consistent throughout the ages, unchanged and unwavering [9]. For example, the digital martial arts curriculum system of Shanghai Normal University provides students with more diverse learning resources, breaking the limitations of traditional teaching in terms of time and space. Some apps set daily practice check-in reminders, and users can take photos or record videos to upload after completing the exercises, and they can also get online guidance and comments from coaches, making martial arts teaching more convenient and personalized.

### **2.2. The Importance of Innovative Teaching in the Inheritance of Martial Arts Culture**

By adopting innovative teaching methods—the form of AR animation, students can more vividly experience the dynamic beauty of martial arts. The detailed movements of martial arts can be intuitively expressed in the form of three-dimensional dynamic models, making abstract concepts easier to understand. The boring content of martial arts learning can be transformed into vivid and inter-

esting tasks or challenges, enabling students to learn the essence more easily and grasp the fun. This approach breaks the space-time limitations of traditional teaching modes and changes the situation of less real-world teaching and interaction. It stimulates students' enthusiasm and initiative for learning, allowing more people to appreciate the charm of martial arts culture and promoting the inheritance and development of martial arts culture.

### 3. Development Status and Case Studies of AR Martial Arts

In recent years, AR technology has been used in the field of martial arts, and Tai Chi, as one of the representatives of traditional Chinese martial arts, has been officially included in the Representative List of the Intangible Cultural Heritage of Humanity.

#### 3.1. The Development Status of Martial Arts

With China's increasing influence on the international stage, the international influence of Chinese martial arts (Wushu) is also continuously enhanced. More and more countries and regions have begun to pay attention to and value the development of martial arts (Wushu), actively introducing and promoting Wushu projects. Meanwhile, martial arts (Wushu) have become an important bridge and tie for cultural exchanges between China and foreign countries, playing a positive role in promoting international friendship and cooperation. On May 3, 2023, the International World Games Association (IWGA) announced the competition events for the 2025 Chengdu World Games in Madrid, Spain, with Wushu becoming an official competition event. This marks the first time Wushu has been included as an official competition event at the World Games, highlighting its elevated status in international sports. The 17th World Wushu Championships will be held in Brasilia, Brazil, from September 7 to 14, 2025. This will be the first time the World Wushu Championships are held in Latin America, reflecting the widespread dissemination and influence of Wushu internationally. In some colleges and universities, they use modern teaching concepts in martial arts (Wushu) teaching [10].

In 2024, the fighting action in *Black Myth: Wukong* last year integrated traditional Chinese martial arts elements, which attracted unanimous praise from many foreign countries. In particular, there are many Chinese martial arts elements, such as Tai Chi, in *Nezha: The Devil's Child Stirs the Sea* released during the Spring Festival this year.

#### 3.2. Case Studies of AR Martial Arts

The AR martial arts system utilizes built-in cameras or external sensors to capture the user's real-world environment and overlay virtual images on the display. Equipped with multiple sensors, the system monitors the user's movement data in real-time. By precisely measuring metrics such as movements, force, speed, and other indicators, the device accurately analyzes training performance and pro-

vides targeted training recommendations and feedback. Tai Chi practice systems that incorporate AR technology, such as Bole AR Baduanjin and Chen's Xinyi Mixed Yuan Taijiquan, provide users with an immersive learning experience through "hands-on guidance" and AI scoring on the screen. These systems not only help beginners quickly master basic movements but also provide personalized feedback and advanced guidance for advanced practitioners. In 2017, the AR Tai Chi large screen developed by BETA SMART can intelligently guide the movements and rhythm for the user, correct the user's irregular movements, improve the exercise effect, and bring more fitness fun and benefits to people.

#### **4. The Application Advantages of AR Manga in the Inheritance and Innovative Teaching of Martial Arts Culture**

The merits of AR education in facilitating historical learning and revolutionizing teaching methodologies are numerous. AR education can craft immersive environments that realistically depict historical events and epochs, sparking students' curiosity and passion for historical studies. Its interactive capabilities assist students in gaining a profounder comprehension of historical contexts and developments. Technology offers tailored learning experiences tailored to the varying abilities and requirements of students, enhancing learning effectiveness. Furthermore, it transcends the constraints of the physical world, enabling students to engage in learning activities at any time, in any location. Ultimately, the implementation of AR education can foster the dissemination and appreciation of historical knowledge, helping students better master historical knowledge.

##### **4.1. Enhancing the Fun and Interactivity of Learning**

AR manga can create virtual martial arts scenes and characters, allowing learners to participate from a first-person perspective and interact with virtual characters, increasing the fun and sense of immersion in learning. Just as gamified AR enhances tourists' experience in agricultural tourism, AR martial arts can also do it [11].

##### **4.2. Creating an Immersive Cultural Atmosphere**

In order to engender an immersive and customized ambiance, the utilization of AR animation, complete with sophisticated scene rendering and audio design, effectively conjures an intense martial arts cultural milieu. This immersive experience transports learners into the very fabric of the martial world. Tailored to the diverse proficiency levels and individual requirements of learners, AR animation is capable of delivering bespoke learning content and guidance. It further enables learners to autonomously modify character avatars, emulating their preferred anime personas. In a manner akin to the "martial arts pedagogy utilizing 3D imagery for posture correction" [12], this approach ensures that learners' movements align closely with standard martial arts techniques, thereby enhancing the

efficacy of the learning process.

## **5. Application Strategies of AR Manga in the Inheritance and Innovative Teaching of Martial Arts Culture**

The application advantages of AR manga in the inheritance and innovative teaching of martial arts culture are multifaceted. AR manga can create immersive scenarios that vividly showcase the charm of martial arts culture, arousing students' interest and enthusiasm for learning. Its interactive features enable students to deeply understand the essence of martial arts movements and techniques. Technology can provide personalized learning paths according to students' different levels and needs, improving learning efficiency. Moreover, it can break the limitations of time and space, making it convenient for students to learn at any time and place. In the long run, the application of AR manga is conducive to the spread and development of martial arts culture, cultivating more martial arts enthusiasts and professionals.

### **5.1. Design Strategies for AR Manga Content**

By endowing characters with distinct personalities and story backgrounds, they become more engaging and educational; integrating significant events and figures from the history of martial arts into the storyline allows learners to appreciate the comic while gaining knowledge of martial arts history, incorporating various interactive elements, such as clicking on characters to trigger martial arts action demonstrations and answering martial arts knowledge questions, enhances learner participation.

### **5.2. Integration Strategies of AR Technology and Teaching Links**

During the class, the use of AR to create scenarios and present virtual characters and animations related to the topic can attract students' attention and stimulate their interest and engagement in the learning content. When explaining martial arts movements and techniques, combined with the three-dimensional models and animation demonstrations of AR comics, students can deepen their understanding through mimicking and interaction. Provide students with AR interactive practice scenes, allowing them to practice martial arts in a virtual environment, and offer real-time feedback and guidance. Additionally, obstacle courses and games should be set up to help students consolidate their knowledge in a relaxed and enjoyable atmosphere. Utilize AR pre-study resources to assist students with self-directed learning outside of class, achieving a combination of pre-study and review to help improve learning efficiency. After a period of study, the learning outcomes are finally evaluated and assessed.

Students collect regional data through GPS positioning, and the AR system automatically generates three-dimensional geographical models and supports multi-terminal sharing. Adopting edge computing technology, data preprocessing is completed locally to reduce server load pressure; Tsinghua University Virtual Simu-

lation Experimental Course By building an AR/VR fusion system for historical scenes such as the Long March of the Red Army, resisting the United States and helping North Korea, students can immerse themselves in historical events. The platform adopts cloud rendering technology to reduce the performance requirements of local hardware, so that ordinary tablets or mobile phones can run smoothly.

## **6. Challenges Faced by AR Comics in the Inheritance and Innovative Education of Martial Arts Culture, and Corresponding Countermeasures**

### **6.1. Challenges Faced**

The production and application of AR comics require advanced AR technology and hardware support, which often come with substantial R&D and operational costs. For many educational institutions and small development teams, this is a burden that is difficult to bear. How to provide a smooth, engaging, and educationally meaningful interactive experience while ensuring technical stability is a major challenge. Many people remain cautious about the application of AR comics in the inheritance of martial arts culture. Breaking down market recognition barriers and effectively promoting AR comics is another significant challenge.

### **6.2. Market Recognition and Promotion**

Governments should increase support for AR technology research and development [13], providing funds and policy support to lower technical barriers and costs. Educational institutions should closely collaborate with industry enterprises to offer relevant courses and training programs, cultivating composite talents who understand both martial arts and AR technology. Through school-enterprise cooperation and industry-academia-research integration, talent support for the creation and application of AR comics can be provided. Creators should be encouraged to deeply explore the connotations of martial arts culture, combining modern aesthetics and technical characteristics to create AR comic content that is both educationally meaningful and creative. Increasing Market Promotion Efforts. Cooperation should be established with martial arts schools, cultural institutions, etc., to jointly promote the widespread application of AR comics in martial arts education.

## **7. Conclusion**

AR comics have shown significant advantages in martial arts education. By integrating technology with creative comic elements, they enhance the fun and interactivity of teaching, effectively promoting the inheritance and innovation of martial arts culture. However, the current scope of its application is relatively narrow, and the costs involved are high, limiting its large-scale adoption. Further in-depth evaluation of long-term educational effects is needed. In the future, it is possible to expand the sample size, apply AR comics in a wider range of martial arts teaching scenarios, continuously optimize content design, and strengthen the integra-

tion with other technologies to comprehensively enhance the effectiveness of martial arts teaching.

## Conflicts of Interest

The author declares no conflicts of interest.

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