

# Feasibility Study on the Construction of Musical Instrument Digital Inculcating Museum in Xinjiang, China

Huxiao Yang, Guojun Sun\*

Xinjiang Normal University, Xinjiang, China

\*Corresponding Author.

## **Abstract:**

Nowadays, in the vigorous development of the digital age, different kinds of digital museums emerge one after another, showing a vibrant development trend. As a part of China's excellent traditional music culture, the traditional musical instrument culture in Xinjiang makes good use of modern digital technology to digitally process, protect and inherit traditional musical instruments. It is imperative to build a digitally Inculcating museum that conforms to the characteristics of the times and the needs of the present society. At the same time, various functions of the digital museum are used to transmit all kinds of information of musical instruments to visitors, so as to promote, protect, educate and inherit the traditional musical instrument music culture in Xinjiang. This paper analyzes the feasibility of building a digital museum of traditional ethnic musical instruments in Xinjiang, China from the aspects of traditional ethnic musical instrument culture in Xinjiang, digital musical instrument collection and digital museum, and puts forward some schemes, measures and suggestions for the construction of digital museum of traditional ethnic musical instruments in Xinjiang, China.

**Keywords:** *Digital Museum, Ethnic musical instruments, Digital.*

---

## I. FUNDAMENTALS OF RESEARCH

### 1.1 Overview

Under the current development trend of the times, the digital process of various museums is intense. Compared with other digital museums, the construction of digital museums of musical instruments has the common nature of other museums, and it is the carrier of art development history through musical instruments or cultural relics themselves. Zhu Xiaodong (2004) thinks that "digital museum is a new mode of cultural heritage management and utilization under the background of information age [1]." Compared with other digital museums, the digital museum of musical instruments also has characteristics that other museums do not have, because the digital museum of musical instruments emphasizes the interaction between musical instruments and visitors. Zhou Na (2010) thinks that "musical instruments are an important carrier of the development of music art and a witness of history. With the changes of history,

culture and production environment, people's values and inheritance methods facing the long-standing Uygur musical instruments are constantly expanding and improving with the development of the times. The inheritance mode of ethnic musical instruments is facing new challenges, construct an interactive multimedia digital museum of musical instruments, which contains the name, attribute, historical origin, rheology, shape and quality, string setting and range, function, performer information, representative repertoire, playing posture, technique and other information of musical instruments, and is diversified and linked in the computer in the form of text, graphics, images, animation, sound and video. In order to achieve the purpose of inheritance, education, display, research and preservation. This is a new digital inheritance mode of musical instruments embodied by the Digital Museum of Musical Instruments [2]." Zhao Chunting (2015) believes that "digital museum is to use data to realize real communication between people and things, which emphasizes the "experience". The way to realize "experience" is to use the existing intelligent simulation, 3D technology, music sampling technology and so on." [3] Chen Ruiyang (2019) believes that "today's society is an era of Internet information. At the same time, digital information technology has been deeply applied in various fields of society. Musical instrument museums should conform to social development and focus on building Internet digital music and musical instrument museums, which can not only store a large amount of information in the museum, but also show infinite advantages in information exchange and sharing [4]."

To sum up, this paper provides research method guidance and scientific reference for the construction of digital musical instrument museum in Xinjiang based on educational inheritance.

## 1.2 Introduction to the Digital Museum of Existing Musical Instruments in China

Up to now, there are the following famous digital museums of musical instruments in China:

### 1.2.1 The digital museum of Chinese ethnic musical instruments

Digital Museum of Chinese Ethnic Musical Instruments is organized and built by the Department of Music Technology of China Conservatory of Music. The museum classifies the columns by the quartering method of musical instruments, which contains most of the traditional Chinese musical instruments, collects the information of each musical instrument to a certain extent, and exhibits them in the form of pictures, audio, playing videos, 3D musical instrument models, acoustic measurement of musical instruments, etc. The following picture is a partial display (Figure 1):



Figure 1: Guqin introduction interface of Chinese National Digital Musical Instruments Museum

### 1.2.2 Museum for oriental musical instrument

Museum for Oriental Musical Instrument of Shanghai Conservatory of Music, founded on November 27, 1987, is the first musical instrument museum in Chinese art colleges. The museum's predecessor was "Chinese Ethnic Musical Instruments Showroom". In the construction of the digital museum, real-life 3D technology is mainly used, and the collection visiting methods are mostly composed of real-life surround and 3D models.

The following figure is a partial illustration (Figure 2):



Figure 2: Exhibition area of Shanghai Oriental Musical Instruments Digital Museum

To sum up, the construction of Digital Museum of Musical Instruments in Xinjiang is a long-term and arduous task, digitization is the content of the current scientific and technological frontier, and the

construction of digital museum is the current museum development trend. The previous research of scholars has played a certain theoretical support and reference significance for the construction of digital museum of musical instruments in Xinjiang. However, what needs to be done is not only to inherit the traditional Chinese ethnic musical instruments, but also to promote and educate such musical instruments, so as to enhance the new generation of young people and the public's sense of identity and pride in our ethnic musical instruments.

### 1.3 Research Methods and Significance

This paper studies the current development status and trend of digital museum of musical instruments by means of literature research, comparative analysis and experiment. The interdisciplinary research method is used to study the feasibility of digital technical support and digital musical instruments interaction needed by the construction of digital museum, and the empirical research method is used to preliminarily build each module in the digital museum of musical instruments, in order to putting forward an implementable path for the construction of digital museum of musical instruments through the practical process.

As an important part of the excellent traditional music culture of the Chinese nation, the minority musical instrument culture in Xinjiang, China is one of the important carriers in the development of our Chinese music culture. With the progress of science and technology and the support of national policies, the digital information age has been unconsciously integrated into all aspects of our lives. Using digital museums to provide rich audio-visual and interactive teaching resources for the public, and making good use of various achievements of digital teaching museums can better inherit, store and carry forward Xinjiang ethnic musical instruments.

## II. ADVANTAGES OF DIGITAL MUSEUM OF MUSICAL INSTRUMENTS

The Digital Museum of Musical Instruments takes the Internet as the medium, integrates all kinds of information resources related to musical instruments, and provides visitors with a more efficient and convenient way to visit. Generally speaking, the overall advantages of the Digital Museum of Musical Instruments can be divided into the following aspects.

On the one hand, as a virtual exhibition platform for the public, the digital museum of musical instruments also means that this Internet platform is not restricted by the field. The size of any physical museum directly determines the ability to collect historical collections, passenger flow and the number of collections and exhibitions. It is precisely because of the limitation of site scale and conditions that the collections of the physical museum can not be fully presented to the visitors, and the cultural resources are not as comprehensive as those presented by the digital museum. At the same time, due to the limitation of exhibition conditions in physical museums, the number of collections in the exhibition can not fully meet the visiting needs of all visitors. When visiting and browsing the Digital Museum of Musical Instruments, visitors are more autonomous than the physical museum, and can get the collections they want to visit and

browse at the first time by searching the resource database by themselves.

On the other hand, the introduction of collection information in physical museums is generally a simple text introduction, voice introduction. Most museums are also equipped with lecturers, which may be enough for some people who come to visit, but for people who come to study, the simple introduction is not enough to study deeply, and the collection information provided by digital museum can be more abundant and detailed, and the information related to the collection can be presented as much as possible through programming technology. The digital museum of musical instruments emphasizes the interaction with collections, and any collection has its cultural environment behind it. However, in the process of independent exhibition in the museum, the cultural environment of the collection itself will be lost to a certain extent, which is difficult to restore in the physical musical instrument museum. Compared with most physical museums, which can only provide a single exhibition mode, the Digital Museum of Musical Instruments can provide a variety of experiences. Visitors can feel the sound effects of musical instrument collections and watch the music videos of the musical instruments they visit, so that visitors can know the information of the musical instruments they visit further, which greatly promotes visitors' interest in learning and visiting.

Secondly, from the connection between digital museum and physical museum, the emergence of digital museums will not have a negative impact on the existence of physical museums. On the contrary, it will play an indispensable role in promoting the development of physical museums, because the existence of digital museums enables physical museums to not only ensure the protection of collections, but also enable more collected exhibits to be exhibited, so that the cultural resources of historical relics can be displayed to visitors for study, research and dissemination as much as possible. At the same time, mark the source of the collection and establish the connection with the physical museum, which plays a role in communication for the physical museum and acts as a media channel between the physical museum and the visitors. Therefore, the connection between digital museums and physical museums should complement each other. As a result of the digital transformation of physical museums in the digital age, digital museums in turn promote the development of physical museums, provide the public with a variety of visiting choices, and better serve the visiting public groups.

### **III. FEASIBILITY ANALYSIS OF CONTENT DESIGN OF MUSICAL INSTRUMENTS DIGITAL MUSEUM CONSTRUCTION**

#### **3.1 Implementation of Digital Museum Construction**

##### **3.1.1 The composition of digital museum**

Digital museum is composed of all kinds of software and hardware superimposed and integrated. In the construction of digital museum, hardware support is needed first, such as high-performance server and bandwidth, and system hardware platform is the foundation of building digital museum. In the software part, we need a series of software such as appropriate operating system, multimedia database, web server

and so on to cooperate with the back-end database to fill in the content of building digital museum.

### 3.1.2 The development mode of digital museum

Looking at the development and construction of the platform of the Digital Museum of Musical Instruments, Most of them construct the traditional C/S (client/server) two-tier architecture based on the web database platform, and further establish the B/S (B/S is the abbreviation of "browser/server", that is "browser/server" mode) three-tier database architecture, which includes three parts: client application program, application server and database server. Compared with the former, the latter's three-tier architecture is more stable and more efficient. At the same time, the back-end database is mostly used in SQL (SQL (Structured Query Language) refers to a database language with multiple functions such as data manipulation and data definition) database, or the database development and application under Oracle and XML language is also a common method.

### 3.2 Design of Collection Resource Module of Digital Museum of Musical Instruments

Through the preliminary classification of musical instruments, four modules of wind instruments, string instruments, plucked instruments and percussion instruments are established in the collection, then divide it into details by the name of musical instruments. Multiple digital exhibition halls named after the name of musical instruments are established. In each musical instrument exhibition hall, only all aspects of musical instrument information displayed by the musical instrument name of the exhibition hall exist. This design method avoids the need for visitors to search for musical instrument names through internal search engines, because the names of various traditional ethnic musical instruments in Xinjiang are not easy for visitors with weak musical instrument foundation or little understanding of traditional ethnic musical instruments in Xinjiang to search for musical instruments smoothly. Enable visitors to enter the Musical Instrument Exhibition Hall through musical instrument pictures, playing techniques, brief introduction and other information. The exhibition hall includes the following resource modules.

#### 3.2.1 Construction of audio and video data resource module

The construction of this module first needs to measure the spectrum of the musical instrument by acoustics. The acoustic properties of musical instruments are summarized and displayed, in order to enable visitors to have a deeper understanding of the sound generation mechanism and sound effect generation principle of each different ethnic musical instrument. At present, mainstream acoustic measurement software such as DAAS (Digital Audio Analyzer System), Ease, SIA Smart Live, etc. can meet the above needs. Secondly, it is necessary to record the sound sample of the musical instruments through the sound source, which contains different sound samples generated by various techniques. For example, the recording of hand drum not only needs to record the drum core sound, but also needs to include the sound samples such as the side sound of hand drum and the ringing sound of hand drum. The software for recording the above sound samples such as Cool Edit Pro 2.0 and Total Recorder, can record the above sound samples. The following figure shows the spectrum analysis diagram (Figure 3) of the D sound of the

Rewap musical instrument recorded by the author using Cool Edit Pro.



Figure 3: Recording waveform

Video data is divided into two aspects, the first aspect is the introduction video of musical instruments, introducing all aspects of musical instruments in the form of videos, such as the data, material, historical origin, rheology etc. of musical instruments. On the other hand, the video data is musical instrument performance data, and the display video resources come from CCTV video programs, such as "Ethnic Music Grand Ceremony", "Fenghua Ethnic Music", "CCTV Ethnic Instrumental Music TV Competition", etc. Through such videos, the excellent music culture of traditional ethnic musical instruments in Xinjiang can be carried forward and displayed to a greater extent.

### 3.2.2 Construction of picture and text resource database

The construction of this module consists of pictures and texts, the main purpose of the picture part is to show the material attributes of musical instruments and the overall structure of musical instruments in detail. It is necessary to cut all kinds of musical instrument entities, and make cross-sectional drawings, vertical section drawings, material connection details, overall structure drawings, plane drawings marked with various materials of musical instruments, and high-definition musical instrument panorama with resolution standard of 8K. The text part needs a detailed text introduction about the musical instrument. At the same time, an expansion link is set on the basis of the original text, by collecting and sorting out all kinds of documents and books of traditional musical instruments in Xinjiang, and taking the time node of the historical development of the musical instrument as an expansion link, the historical facts recorded in these documents are conveyed, for example, "Illustration of Musical Instruments Production of Ethnic Minorities in Xinjiang, China" [5] published by Xinjiang Fine Arts Photography Publishing in 2009.

### 3.2.3 Educational resource module of digital museum of musical instruments

This module mainly reflects the basic universal education provided by digital museums to visitors, the purpose is to spread the traditional musical instrument music culture in Xinjiang, and at the same time provide visitors with a certain learning platform. Through the interaction between visitors and musical instruments, visitors can cultivate their interest in this kind of musical instruments, and then promote the desire to continue learning or understanding in real life, instead of carrying out professional musical instrument teaching and training.

### 3.2.4 Educational advantages of digital museum of musical instruments

#### 1) The educational advantages of digital museums

In terms of public education, the educational function of digital museum can more completely supplement the capabilities that physical museums do not have. The common educational methods in most physical museums can be divided into two types, 1. Visitors learn to visit the exhibits displayed in the museum independently. 2. Various educational activities carried out by the museum, "This seemingly active way of education is actually more" passive "because visitors, whether they visit independently or participate in educational activities, the content is also limited to the exhibits and the theme content of the activities, which can not make visitors visit independently as much as possible. While the digital museum can display all the relevant contents that visitors are interested in through back-end database and front-end retrieval, which is convenient for visitors to visit and study." At the same time, digital museums can provide more learning and teaching methods, such as audio and video, picture and text learning methods, and interact with digital collections to gain knowledge in practice.

#### 2) The advantages of digital musical instrument collection education

Music education, as a part of art education and aesthetic education, is different from the education methods and education methods of other disciplines. Peng Jixiang thinks: "The aesthetic education function of art is different from moral education and other types of education forms. The educational function of art is based on aesthetic value and has aesthetic significance and artistic charm." [6] In physical museums, when visitors visit musical instrument collections, the learning activities of this kind of musical instruments can only stop at visiting due to the limitation of objective environmental conditions. While the digital musical instrument collection has realized the possibility of more educational ways, such as interactive 3D musical instruments, guided musical instrument teaching videos, etc. Relying on the Internet platform, breaking the limitation of objective environment, it can better realize the teaching of musical instruments and the education of music culture, and then achieve the expected goal of aesthetic education to a certain extent.

### 3.2.5 Construction of teaching resource database of musical instrument 3D interactive model

The 3D model of musical instruments needs to be built with the parameters and materials of various musical instruments. The software used by the author is 3DMAX+ZB rush

The 3D model of the initial musical instruments is built through 3DMAX. Material the base model with ZB rush. After rendering operation, the 3D model of musical instruments can be made. Under the current technical conditions, there are many ways to make 3D models, such as Maya, Rhinoceros and other 3D software can make 3D models. However, the basic models involve the restoration of physical musical instruments, and it is necessary to restore the data of physical musical instruments as much as possible in terms of materials and structures. After modeling musical instruments, it is necessary to make musical instruments interact. Adding the sound samples recorded by the sound source into the established 3D

model of the musical instrument, and facilities trigger range, such as tambourine of percussion instruments. When visitors hit the drum surface, set the trigger range of drum core sound, and trigger the response range of drum edge sound when hitting the drum edge. To achieve this requirement, unity3D software can be used, and the interaction with the 3D model of musical instruments can be preliminarily realized by adding Audio source component. The following picture shows the head part (Figure 4) of the traditional musical instrument Ai Jieke (Ai Jieke, Uygur traditional string-pulling ethnic musical instrument) produced by the project team using 3DMAX+ZB rush.

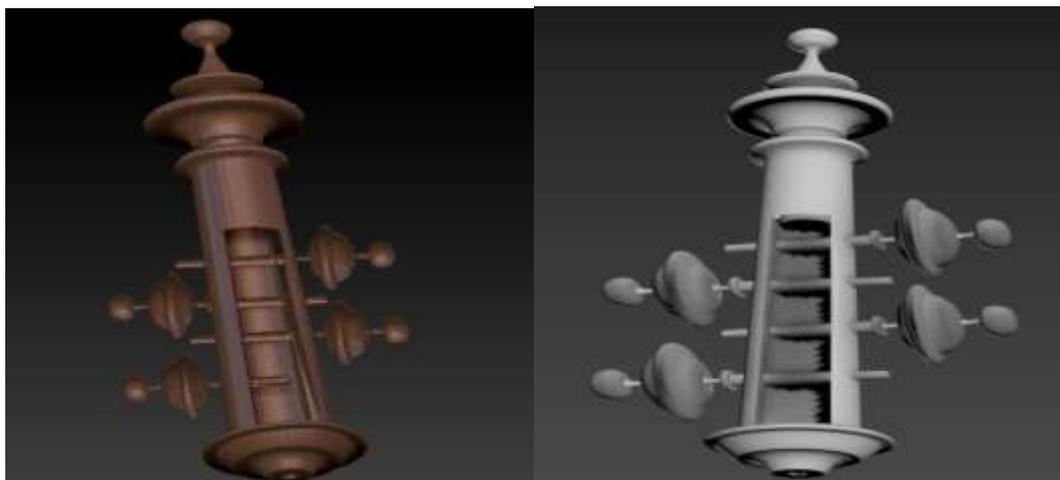


Figure 4: Recording waveform

### 3.2.6 Musical instruments teaching and construction of music score resource database

When visitors interact with 3D simulated musical instruments, this module can provide basic knowledge and skills teaching about this musical instrument. Provide correct musical instruments teaching for visitors' experience activities in the form of video, text and pictures, so that visitors can feel the fun of playing musical instruments in the process of learning. In the selection of music in demonstration teaching, simple versions of music that are familiar and widely sung are selected for demonstration. Visitors can play through ethnic musical instruments and introduce the special sound attributes of traditional ethnic musical instruments, which will make visitors feel different musical charm. The establishment of this module is mainly divided into two aspects, one is the musical instruments teaching module, and the other is the music score resource module. In the musical instruments teaching module, the forms adopted can be but are not limited to the following forms:

#### 1) Audio and video teaching forms

Teaching by recording each kind of musical instruments teaching video in advance, which should include basic music theory teaching part, comprehensive musical instruments introduction part, from simple to complex performance techniques, and teaching part of music that visitors choose to be interested in.

## 2) The 3D model of musical instrument guides the teaching form

Learning by setting guide points on the 3D model of musical instruments. Guiding points are divided into pitch position guiding learning and technique learning. In the process of visitors' musical instrument experience, they can't find the pitch they want to play quickly, such as the musical instrument Rewap. After passing the basic music theory teaching in audio and video teaching, visitors want to play the D sound of C4. By clicking on the note they want to play, the 3D model will guide visitors to the first step: click on the position of 1 string and 2 products without letting go of their left hand, the second step: pluck 1 string with their right hand, thus triggering the pitch sound sample of Rewap instrument D. If visitors want to learn the teaching of playing techniques of kneading strings, The 3D model will prompt the visitor to the first step: click on any position of 1 string without letting go of their left hand, the second step: play a string with right hand, the third step: drag 1 string back and forth up and down. At this time, the 3D model instrument triggers the sound sample of kneading string sound effect, and the construction of the above models can be completed by using the software listed in the chapter of building the resource database of 3D interactive model of musical instruments in this paper.

In the music score resource module, the collected music scores need to be processed in many aspects:

### 1) Translate music scores

In the music scores of ethnic musical instruments, many music scores are written in minority languages, so it is necessary to translate the music scores information, so as to sort out all the music scores written in Chinese common languages.

### 2) Simplify the music score

The harmony texture of most music scores is complex, the playing techniques are changeable. It is difficult for most visitors to visit. It is necessary to simplify the collated music score, by simplifying the music score, some difficult-to-play change sounds and decorative sounds are omitted, and only the main melody sounds are presented, which can not only make the experiencer get a better music experience, but also get a sense of accomplishment in playing music, which greatly enhances the interest in this kind of musical instruments, and psychologically urges the experiencer to continue learning.

### 3) The music score standard

When sorting out music scores, all kinds of music scores are uniformly sorted into simple scores for presentation. Most visitors are interested in music, but their foundation is weak. Simplified notation is easier to learn and understand for this group of visitors, and it is easier to grasp the rhythm and beat. Therefore, in the process of compiling music scores, it is feasible to unify it as a music score standard.

## **IV. PROBLEMS AND THOUGHTS**

To sum up, under the current level of science and technology, it is completely feasible to realize the above construction of digital museum of musical instruments, and there are still many problems to be solved at the same time.

### **4.1 The Collection of Library Resources**

Collecting, preserving and exhibiting collections of historical value and historical significance is one of the important functions of the museum. We can use a series of technical means, such as 3D modeling technology, AR panoramic technology, etc., show the attributes and materials of musical instruments completely. However, how to use modern technology to perfectly restore historical relics and completely inherit and convey the historical and value significance contained in cultural relics is a challenge to the construction of digital museum of musical instruments in Xinjiang.

### **4.2 Mass Education**

The museum has the characteristics of large audience and wide communication area. This feature makes the mass education function of museums of great educational significance. The Digital Museum of Musical Instrument in Xinjiang, as a museum of music and art, how to make good use of the communication function of music, make good use of the three properties of artistic aesthetic education, such as influence character by environment, education through entertainment and moving with emotion, so that visitors can not only bring aesthetic experience to visitors by music, but also transmit Chinese excellent traditional culture and Chinese excellent traditional ethnic music culture to visitors through music instrument education.

## **V. CONCLUSION**

In today's digital age, all industries are intense under the current situation of digital transformation. As a public facility with high historical heritage value, large audience and rich educational nature, museums need to use digital technology to develop and better serve the people. Xinjiang has been a part of China since ancient times, Xinjiang's traditional ethnic musical instrument music culture is an important part of Chinese excellent traditional music culture. Establish a digital museum of traditional ethnic musical instruments in Xinjiang, China, using digital technology and relying on the Internet platform, we can better carry forward and inherit the traditional music culture of ethnic musical instruments in Xinjiang, and better present the beauty of ethnic musical instruments. By carrying forward the Chinese music culture and spreading Chinese musical instruments, it is a help for us to establish national self-confidence and cultural self-confidence. Therefore, the construction of digital museum of traditional musical instruments in Xinjiang not only conforms to the current social development trend and the social demand for museum transformation, but also plays a positive role in promoting the dissemination, inheritance and development of musical instruments in Xinjiang.

## **ACKNOWLEDGEMENTS**

This paper is a phased achievement of the National Social Science Fund Art Project "Digital Inheritance and Development of Musical Instruments in Xinjiang, China" (Project Number: 20ED201) (Project Number: 20ED201).

## **REFERENCES**

- [1] Xiaodong Zhu (2004) Research on Key Technologies in the Digital Museum, Northwest University
- [2] Na Zhou (2010) Research on the Digital Inheritance of Xinjiang Uygur Musical Instruments, The Sea of Songs(01)
- [3] Chunting Zhao (2015) On the Digital Construction of the Musical Instrument Museum, musical instrument (01)
- [4] Ruiyang Chen (2019) Building a digital museum of music and Musical Instruments — takes the Oriental Musical Instruments Museum as an example, musical instrument (06)
- [5] Qiang Duan Production map of ethnic minority Musical Instruments in Xinjiang, China. Published by Xinjiang Fine Arts and Photography Publishing House. Published in the first year of 2009
- [6] Jixiang Peng An Introduction to Art. Published by Peking University Press. Published in the year of 2006.