

Research Article

Research on Digital Protection and Inheritance of Huanglongfu Cultural Heritage

¹Xiaowei Jiang, ²Jianfeng Hou and ³Craig Pearsall

¹Changchun University, Changchun 130022,

²Jilin University, Changchun 130000, China

³No Climb Products Ltd, Hertfordshire AL97JE, UK

Abstract: The research aims to discuss the digital protection and inheritance countermeasures of Huanglongfu cultural heritage, providing the basis for the protection and development of Huanglongfu cultural heritage. Through analyzing the importance of Huanglongfu cultural heritage and the problems existing in the digital protection and inheritance of Huanglongfu cultural heritage, the specific measures that should be taken in the digital protection and inheritance of Huanglongfu cultural heritage and the proposals how to reasonably develop and utilize the digital achievements of Huanglongfu cultural heritage are put forward. Using advanced digital technology to protect the cultural heritage of Huanglongfu is a necessary and effective method, is a historical mission given by the times and is necessary for culture protection, cultural transmission and cultural renaissance. Only digitizing the cultural heritage of Huanglongfu can be more conducive to the further inheritance and only reasonable exploitation and utilization can bring better economic benefits, achieving a double harvest of protection and inheritance and economic development.

Keywords: Cultural heritage, digitization, Huanglongfu, inheritance, protection

INTRODUCTION

Huanglongfu, now Nong'an county, Changchun city, Jilin province, is one of China's famous historical cities. Huanglongfu has had human activities since the neolithic age. It is one of the cradles of the northeast civilization and has a history of more than 7,000 years. The ancient building Liao tower is the symbol of Nong'an county and has entered the list of the seventh batch of key cultural relics protection units in China. Huanglongfu has a wealth of material cultural heritage. At present, the number of cultural heritage in Nong'an county ranks the forefront in the whole province (Changchun Institute of Cultural Relic Protection, 2014). This rich cultural heritage of Huanglongfu is an indispensable part of Chinese cultural heritage. It has profound connotation and unique value and is the unique culture of northeast China. However, in recent years, due to inadequate protection, it is disappearing gradually. How to effectively inherit and protect this precious cultural heritage of Huanglongfu, so that the Huanglongfu civilization can be well inherited, has become a common concern of the whole society (Jiang and Liu, 2018). At present, all countries in the world are carrying out digital protection and development and utilization of cultural heritage. The digitization of cultural heritage has shown another unprecedented

"media transfer" in the history of human culture, just like the leap development of human civilization caused by paper media and electromagnetic media (Zhao, 2015). Digital technology has the characteristics of large capacity storage, high speed calculation, multimedia presentation and long-distance transmission. Using advanced digital technology to protect cultural heritage is a necessary and effective method (Zhou *et al.*, 2011), a historical mission given by the times and a need of cultural protection, cultural communication and cultural renaissance (Wang, 2009). It need to seize the opportunity of the fusion development of the culture media and digital technology, updating the concept of thinking, especially to give play to the role of the science and technology as the first productivity (Zhao, 2014). Specifically speaking, it is to introduce the digital technology into the protection of Huanglongfu cultural heritage, giving play to the role of the digital technology to protect and inherit Huanglongfu cultural heritage. Otherwise it could not really protect and make good use of Huanglongfu cultural heritage.

The research aims to discuss the digital protection and inheritance countermeasures of Huanglongfu cultural heritage, providing the basis for the protection and development of Huanglongfu cultural heritage.

PROBLEMS EXISTING IN DIGITAL PROTECTION AND INHERITANCE OF HUANGLONGFU CULTURAL HERITAGE

Problems of value concept and cognition:

Huanglongfu culture has a long history and is the unique culture of northeast region throughout the country. With a history of 7,000 years, Huanglongfu has accumulated countless brilliant and splendid cultural heritages, which is a source of pride for all of us in the northeast (Wang, 2009). But while we are proud and content, have we ever wondered whether these "cultural heritages" are still alive? If we lose these "cultural heritages", what else can we say about pride, whether we can face future generations with face and how to explain to the ancestors and we will be condemned by history. If we don't want to be sinners and continue to be proud, we need to preserve our ancestral property and root-our cultural heritage so that we can flourish.

With the continuous development of urban construction, the "old city reconstruction" has been carried out in an aggressive manner and the development driven by interests has caused serious damage to many historical and cultural relics of Huanglongfu, so the protection of Huanglongfu cultural heritage is facing severe challenges. There are many reasons for the poor protection. First, the public protection consciousness is still weak, lack of consensus; second, the phenomenon of "constructive destruction" is serious and the relationship between protection and development is mishandled; third, the legal system is not perfect and the law enforcement is not effective; fourth, the protection funds is deficient; fifth, the management mechanism is not scientific, paying attention to the "world cultural heritage application" and looking down on management (Wang and Zhang, 2014).

These reasons are ultimately a problem of value concept and cognition. The value concept is the core of the whole national culture and the change and renewal of the concept is the key to protect the cultural heritage. The protection of Huanglongfu cultural heritage has not been paid enough attention and the digitization of its cultural heritage has certainly not attracted enough attention from the public, which is deeply regrettable.

Problems of research team and infrastructure

construction: The construction of scientific and technological talent team is the fundamental and guarantee of cultural heritage protection. There is a shortage of high-tech talents in the research institute of cultural heritage protection in Nong'an county, lacking a talent team of digital protection of cultural heritage. At the same time, there is a shortage of excellent infrastructure and technology of digital protection of cultural heritage. It is not enough for the cognition and understanding of digital meaning of cultural heritage.

The digitization of cultural heritage not only requires the employees to have a high level of professional culture, but also should be equipped with professional basic equipment. At present, domestic some provinces have set up the special research center of science and technology protection of cultural relics, established the protection laboratory and purchased some professional equipment. Hardware and software have begun to take shape, but these are limited to individual developed cities. The small county, such as Nong'an, due to the limitation of manpower and material resources, is basically unconditional to talk about digital protection of cultural heritage.

Problems of cross- discipline, cross-field and cross-

major research: The digital construction of cultural heritage is a comprehensive project, which has extensive connection with natural science, social science, humanities, politics, economy and so on. It could be said that it is a grand project for the whole society. With the characteristics of interactive development and interdisciplinary integration of basic research, applied research, soft science research, it could neither be classified into a certain discipline, nor has it laid a foundation for emerging disciplines (Wang, 2009). How to grasp this characteristic, correct their respective positions, under the correct guidance of theories and methods of various disciplines and integrate the latest research results of various fields comprehensively or organically will be a very difficult problem in the process of digital protection and inheritance of Huanglongfu cultural heritage. The digital construction of American cultural heritage is divided into disciplines in content and emphases in technology, which ensures the comprehensive and in-depth research to a certain extent. And each part can be combined into an organic and systematic whole. The United States emphasizes the coordination and cooperation of all parties, requiring the experts from all aspects to carry out the project construction jointly. Participants of the project include users, publishers, software developers, equipment manufacturers, database vendors, communication companies, libraries, supercomputer centers, commercial laboratories, etc. (Zhang, 2004). This kind of cooperation is mainly reflected in two aspects: on the one hand, it is led by the state and it combines universities, libraries, academic groups and companies at all levels. These institutions share resources with groups and invest a lot in human, material and financial resources. On the other hand, big American companies such as IBM, APPLE and DELL have joined actively to promote the industrialization and marketization of new achievements (Zhang, 2004).

MATERIALS AND METHODS

This study was conducted in 2018 in Changchun, China.

Changing thought concept: The state attaches great importance to the digital protection and inheritance of cultural heritage. The digitization of cultural heritage plays an increasingly important role in promoting the development of cultural industry and science and technology and in the development of national economy. In view of the current situation and trend of digital development of cultural heritage at home and abroad, the existing thought barriers and gaps should be recognized. In order to grasp the future opportunities and seize the commanding heights of culture and technology, governments at all levels and relevant departments should improve their understanding of the role of digital productivity, change their thought concepts and make full use of digital high-tech means to conduct digital excavating, protection, inheritance and utilization of cultural heritage (Wang, 2009). Especially for the Huanglongfu cultural heritage, which has profound connotation and unique value, relevant departments more should strengthen publicity, change thought concepts and make full use of advanced digital technology to protect and inherit it.

We can make full use of the Internet to promote the cultural heritage of Huanglongfu. By writing blog posts on Huanglongfu folk tales, recording video, setting up Huanglongfu relic website and publishing it on the Internet, people will enjoy the colorful cultural heritage of Huanglongfu when surfing the Internet. At the same time, various topics and activities related to the cultural heritage of Huanglongfu can be organized on the Internet and through discussion and joint participation, the purpose of deeply understanding and propagandizing the digital protection of Huanglongfu cultural heritage can be achieved (Zhou, 2015).

Strengthening and perfecting related digital legal system: Jilin province government, Nong'an county government and relevant departments should take into account the reality of the digitalization construction of cultural heritage in this province and formulate and improve relevant incentive policies for the digitalization construction of cultural heritage by referring to the laws and regulations of other provinces as soon as possible, so as to provide the law and policy guidance for the digital construction of Huanglongfu cultural heritage from the aspect of laws and regulations; At the same time, the protection of digital intellectual property rights should be attached importance, Huanglongfu cultural property rights trading center should be set up and the responsibilities, rights and obligations of the government, social forces and individuals in the digital protection and utilization of Huanglongfu cultural heritage should be clarified. The scientific, forward-looking and operable nature should be taken full account when formulating all relevant policies and regulations. Only in this way can it play the role of safeguard and support of policies and regulations,

creating a good policies and regulations environment for the digital protection, inheritance and utilization of Huanglongfu cultural heritage.

Strengthening the construction of inter-disciplinary talent team with high quality: The sufficient protection of Huanglongfu cultural heritage will play an important role in promoting economic development. The government should attach great importance to the digital construction of Huanglongfu cultural heritage. Constructing the digital Huanglongfu cultural heritage requires a high-level digital construction team of cultural heritage. Therefore, government departments should explore to establish the training mechanism for compound talents of multi-channel cultivation, diversified evaluation, multi-level use, multi-way incentive and multi-directional service, arrange necessary special funds for talent training and increase the efforts of localized talents training and talent introduction, especially to strengthen to the cultivation of cultural and art professional talents, culture and arts management talents and the culture and science and technology talents (Wang, 2009). With universities as the main body, it should integrate nationality, humanity, art, information, engineering and other discipline resources, taking the training of compound high-level talents as an important work content and bringing it into the economic development of cultural industry and the construction plan of talent team. At the same time, it should strengthen cooperation and exchange with other countries, constantly enriching the information base of experts and talents for the digital protection of cultural heritage and forming a high-level and distinctive digital talent team of cultural heritage as soon as possible.

Accelerating the establishment of virtual museums and digital demonstration projects: It should speed up the establishment of Huanglongfu virtual museum, which plays a vital role in propagandizing the cultural heritage.

At present, how to build digital cultural industrial parks, how to build digital demonstration projects and how to create competitive products of digital heritage, many places have brought them into research and planning, so as to achieve the goal of protecting and inheriting cultural heritage. Nong'an country (Huanglongfu) should also set up a digital demonstration project of cultural heritage, providing good conditions for the protection of cultural heritage and guarantee for the development of digital culture industry of Huanglongfu. The established demonstration project could combine the cultural characteristics of specific customs culture, folk technology, traditional clothing and Huanglong drama to create various cultural products. At the same time it should pay great attention to setting up brand and competitive products awareness and should actually do a good job of the creation of competitive products and benign interaction of market, so as to build a batch of

digital competitive products of heritage that have powerful Huanglongfu cultural characteristics and high art value and embody Huanglongfu folk-custom, thus promoting them to the whole country and the world and realizing the protection and inheritance of Huanglongfu cultural heritage (Zhou, 2015).

Establishing and improving the fund guarantee system of digital construction: The finance of Jilin province and Nong'an county should gradually increase the capital investment of the digital construction of heritage, promoting the development of the digital construction of Huanglongfu cultural heritage, establish and improve a financial guarantee system that relies mainly on government investment while making social participation subsidiary, actively encourage and further improve the preferential policies of social funds, especially funds outside the province, for investing in various forms, strive for financial assistance from enterprises, individuals, various international organizations, international consortium and overseas friends, set up special funds for digital protection of cultural heritage at provincial level and bring them into the annual budget of government functional departments and special funds should be formulated management method to conduct long-term supervision and management and performance evaluation (Wang, 2009).

DIGITAL KEY TECHNOLOGY OF HUANGLONGFU CULTURAL HERITAGE

Site's 3d data acquisition technology: The appearance of 3d laser scanning technology makes the acquisition of 3d data more accurate, fast and convenient. The design of the laser scanning system varies greatly depending on its application. There are contact and non-contact types. For the moment, non-contact 3d scanners are used more frequently (Zhang, 2010).

The depth image obtained by the 3d laser scanner is provided with coordinate system, which is convenient for subsequent measurement. That is, the horizontal axis X and vertical axis Y are within the horizontal scanning plane, while the Z axis is perpendicular to the XY plane. By using the distance detection function of the scanner, the distance L between the scanning instrument and the scanned scene or cultural relics can be easily obtained. If the horizontal scanning Angle value of laser beam is α and zenith observation value is β , the coordinate calculation formula of 3d laser foot point can be obtained (Zhang, 2010):

$$\begin{cases} X = L * \cos \alpha * \cos \beta \\ Y = L * \cos \beta * \sin \alpha \\ Z = L * \sin \beta \end{cases}$$

A combination of 3d scanner and digital camera is usually used to scan the main body of the site. While the laser scanner obtained the point cloud data of the

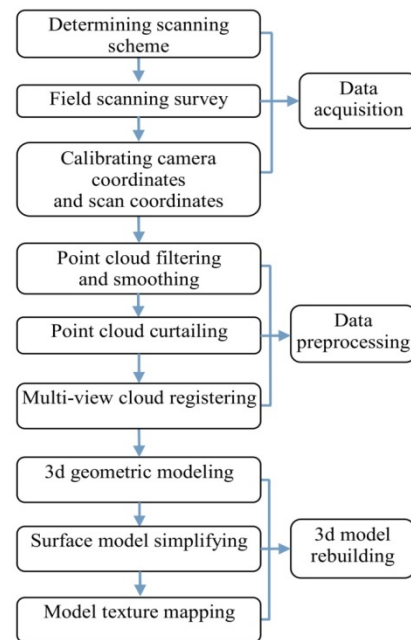


Fig. 1: Process of 3d laser scanning modeling

scene, the digital camera synchronously obtains the corresponding scene texture information and through the later data processing to generate the realistic 3d model of the scene (Zhou *et al.*, 2011).

Generally, modeling should include data acquisition, data pretreatment and 3d model reconstruction three stages and its workflow is shown in Fig. 1.

Reconstructing and drawing technology of site scene:

3d reconstruction of ancient sites: Huanglongfu ancient site involves all kinds of objects, ranging from topography, architecture, burial pit, etc., to pottery, bone ware, stone tools and other unearthed cultural relics. Because these objects are of different sizes and require different precision in digital protection, it is necessary to select specific devices according to the characteristics of objects to collect appropriate data and then reconstruct 3d models according to the data. When the 3d models of all objects are obtained, the models are integrated to make them unified in format and coordinate, so as to build a complete scene (Zhou *et al.*, 2011).

Drawing technology: The drawing technology of cultural relics and cultural sites is to calculate the brightness and color composition of the light that can be projected into the eyes of an observer, according to the illumination model on the basis of the principles of optics and convert it into the color value suitable for the graphic display equipment, so as to determine the color and lighting effect of each pixel on the projection screen and finally to generate a realistic graphic. This

kind of realistic graphic is represented by the colors and shading tones on the surfaces of cultural relics and sites. It is related to the properties of materials on the surface of objects and the light energy radiated from the surface to the line of sight. Its calculation is complex and the calculation is large. Therefore, the drawing of cultural relics and cultural sites is different from the general drawing technique and it requires special equipment and particular techniques and methods (Zhou *et al.*, 2011).

Production of virtual reality scene demonstration (Zhou, 2006): Virtual Reality technology adopts VRML (Virtual Reality Modeling Language). VRML can realistically restore the environment and objects that exist or will exist in real life on the computer through the network and support the light, material, voice and sound effect, with strong sense of reality and interactivity. VRML is able to integrate 3d, text and multimedia into a unified whole while closely combining with the Internet. Therefore, VRML is chosen as a tool to build virtual reality scenes.

The production of virtual scene display system is divided into static model making part and dynamic control part.

A static model can extract a rendered 3d model from a database. The purpose of 3d model establishment is to accurately record the geometric shape of Huanglongfu cultural relics, so the data is large and the models in the virtual reality scene are too complex. So these 3d models need to be simplified. The way to simplify the model is to build a series of models with different details for different occasions, such as vision and close-up.

Dynamic control part includes freedom control, input control, collision detection, etc. In addition, it could provide sound effects and text for some nodes of the system.

RESULTS AND DISCUSSION

Contributing to the development of digital culture industry: Digitizing Huanglongfu cultural heritage is conducive to the development and innovation of digital culture industry, which will certainly drive the common development of culture and museum tourism industry, media industry, animation and game industry, advertising industry and other related cultural industries.

Culture and museum tourism industry: Government departments should give full play to the advantages of rich cultural heritage and carry out the digital construction of Huanglongfu cultural heritage as soon as possible, which will certainly promote the great development of the culture and museum tourism industry and at the same time be more beneficial to the digital protection and inheritance of Huanglongfu cultural heritage.



Fig. 2: Appearance of the "spring nabo" of Emperor of Liao Dynasty (created by Haonan Li based on the picture-story book "Fierce Fighting in Huanglongfu" painted by Youwu Xu)

With the help of virtual technology, some damaged or disappeared Huanglongfu material cultural heritage could be restored, such as virtually rebuilding the buildings of Liao and Jin Dynasty style, one thousand year old temple Huanglong temple, the palace of the first founder of Liao Dynasty, the palace in which Emperor Huizong and Qinzong of Song Dynasty were locked up, the palace of station troops of the first founder of Jin Dynasty and the martial hall in which the aristocracy of Liao Dynasty held "first fish feast" and "first goose feast", as well as the legendary palace of Dayu stopping dragon, drying clothes door of Rengui Xu, the palace of King dongming of Fuyu, e.t.c (Gu, 2005) and used for simulating the evolution in the virtual world. By using virtual reality technologies such as multimedia virtual scene modeling and multimedia virtual scene coordinated display, the immaterial cultural heritage of Huanglongfu, especially those immaterial cultural relics that exist only in historical legends and have no definite written records, could be truly reproduced and the multimedia digital museum including text, voice, image, video and virtual reality could also be set up, for example, according to the legend of magic lamp in Boluo lake to virtually reconstruct Boluo lake and the "seven-color magic lamp" in the lake, as well as creating the "spring nabo" of Emperor of Liao Dynasty to simulate and reproduce the historical scene in those days (Gu, 2005), as shown in Fig. 2 (Zheng and Xu, 1983).

Media industry:

Traditional media industry: The digitization of cultural heritage is the important foundation of the great development of traditional media industry in the digital age and the technical basis of traditional media communication. Carrying out the digital construction of Huanglongfu cultural heritage as soon as possible could provide the content of "special and powerful" for the traditional media industry of Nong'an, could greatly promote the development of the traditional media industry (Zhao, 2014) and could effectively protect and inherit the cultural heritage of Huanglongfu.

Network media industry: The unique Huanglongfu cultural heritage could promote the breakthrough development of network media industry, while the

digitalization of Huanglongfu cultural heritage could more promote the great development of network media industry (Zhong and Zhou, 2015). Because, compared with the traditional media industry, the network media industry is a kind of "attention" and "influence" economy. It more need unique contents that could attract people's attention.

The website of "People's Government of Nong'an County" has set "Huanglong culture" as one of its columns. Relying on the cultural heritage that has unique value and rich connotation, it agglomerates "attention" constantly. The column "Huanglong culture" includes more than ten sub-columns, such as folk legends, Nong'an historical narrative, folk customs, Huanglong calligraphy, folk art forms, Huanglong painting, folk craft and historical relics.

Animation and game industry: At present, it should energetically carry out digital protection and development of Huanglongfu cultural heritage, constructing the database of cultural heritage and ancient books and the "Huanglongfu digital museum", making the Huanglongfu culture heritage in the form of digitization display in front of people, which will greatly facilitate the animation game creators to collect materials, enrich and stimulate creativity and quickly turn Huanglongfu cultural heritage into animation game products. Making use of the digital achievements of cultural heritage to create animation game products is a kind of "productive protection" with the nature of protection and inheritance.

Making use of digital historic sites to create animation game: It should carry out the digital construction of Huanglongfu cultural heritage as soon as possible, so as to provide a good basis for the creation of "virtual reality" of animation games on Huanglongfu historic sites, so that the creators of animation games could easily create them into animation game scene. To create this kind of animation game, on the one hand, it requires digitized achievements at the physical level of ancient cities, ancient battlefields, historical and cultural celebrities and major historical events; on the other hand, it requires digitized achievements of ancient books and literature (Zhao, 2014). These two aspects of digital achievements are the important foundation for creating this kind of animation games, such as "authenticity" ancient cities, ancient battlefields, historical and cultural celebrities and important historical events. The digitization of materialized level is conducive to the creation of "real" scenes of animation games, while the digitization of ancient books is conducive for creators to conveniently collect the "real" elements of animation game plots, characters and other relevant contents. It is believed that such animation game works of "virtual and real" historic sites of Huanglongfu will be of great value, because it will enable viewers and players to

obtain many accurate historical and cultural knowledge in the process of watching or experiencing, which will be the best inheritance of Huanglongfu cultural heritage.

Making use of digital immaterial cultural heritage to create animation game: Huanglongfu immaterial cultural heritage resources are very rich and unique. The digital construction of immaterial cultural heritage should be promoted as soon as possible so as to form the digital achievements and provide rich materials for the creation and production of such animation games. At the same time, the digital construction of Huanglongfu ancient books also should be promoted as soon as possible, so that animation game creators could develop products with these materials in a very convenient way, enhancing the originality of animation games. The best protection for the immaterial cultural heritage of Huanglongfu will be to create animation game products based on the digital achievements (Xing and Yang, 2017).

Advertising industry: The digitalization of Huanglongfu cultural heritage could promote advertising creativity and promote the development of advertising industry.

It should push forward the digital construction of Huanglongfu cultural heritage as soon as possible, after that, on the basis of its digitization, to construct the network media platform such as Huanglongfu digital museum and immaterial cultural heritage database (Jiang and Sun, 2015) and to make use of these digital achievements to research and develop advertising, which will play a great role in promoting the development of advertising industry and make Huanglongfu cultural heritage get effective protection and inheritance.

Contributing to publicizing and popularizing Huanglongfu culture: Digitizing Huanglongfu cultural heritage could further explore the unique value of Huanglongfu culture, so that the world has a deeper understanding of northeast regional culture in China. In addition, digital protection and utilization of the cultural heritage of Huanglongfu plays a positive role in enhancing the image of Nong'an county and increasing its popularity and reputation. The development and promotion of digital products of Huanglongfu cultural heritage is of great significance to the publicity and popularization of Huanglongfu culture.

Digitizing Huanglongfu cultural heritage is also conducive to the development of cultural and creative brand. The construction of cultural and creative product brand is another kind of protection for cultural heritage in the long run, as shown in Fig. 3 and 4. With a good brand, cultural heritage could also find a place to land and form a stable industrial chain (He *et al.*, 2018).



Fig. 3: “Spring nabo” creative product brand image design (Jiaojiao Li)



Fig. 4: “Spring nabo” creative product design (Jiaojiao Li)

CONCLUSION

Huanglongfu cultural heritage is the most essential part inherited by Huanglongfu culture and it is the material and spiritual wealth worth protecting left over from the Huanglongfu history. It does not refer to the whole culture of Huanglongfu, but the essence of Huanglongfu culture. Huanglongfu cultural heritage is an important witness of Huanglongfu civilization. The digitalization of Huanglongfu cultural heritage is to fully apply various science and technology to transform the cultural heritage into a digital form, to produce with the cultural heritage as resources, to provide cultural products and services to the society, to preserve and protect the cultural heritage permanently and to realize the reproduction, regeneration and utilization of the

cultural heritage (research, communication and display), so as to reflect the historical value of the cultural heritage and contemporary people watching over the heritage and future people possessing the rights of the heritage.

Digitizing Huanglongfu cultural heritage has extremely profound social and political significance and the time is pressing, so it must start the related research engineering of digitizing Huanglongfu cultural heritage as early as possible and must protect and develop the rich resources as soon as possible. Using digital and network technology, it could transmit the rich and splendid Huanglongfu culture to the front of the national and global consumers in the form of bits. At the same time, developing related industries, it could transform the resource advantage of Huanglongfu culture into economic advantage, which not only digitally protects and inherits Huanglongfu cultural heritage, but also creates a huge economic and social benefit.

ACKNOWLEDGMENT

This research is supported by the Thirteenth Five-Year Social Science Project of Education Department of Jilin Province under the grant No. JJKH20170503SK.

CONFLICT OF INTEREST

We declare that we do not have any commercial or associative interest that represents a conflict of interest in connection with the work submitted.

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