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Study on the Approach of Integrating Cultural Heritage into Sustainable Education in the Context of Digitization

Meng Chen[1,2,*], Shu Wu[1], Fangyuan Wang[1] & Xuefei Pang[1]

[1] *School of Architecture and Urban Planning, Shandong Jianzhu University, China*

[2] *Shandong Provincial Research Center for Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, China*

Abstract: Along with the development of the field of digital culture, the preservation and presentation of cultural heritage has begun to transform into a digital paradigm. How to integrate digital cultural heritage with the education of different groups is an important topic. This paper explores the path of digital preservation, utilization and interpretation of cultural heritage, including information acquisition and processing, information storage and management, spatial simulation and analysis, and heritage interpretation and dissemination. Following that, it explores the paths and methods of integrating cultural heritage into sustainable education, taking into account the basic demands of social practice education, general education, professional education and public education. This paper argues that the integration of digital cultural heritage into sustainable education can not only popularize the knowledge related to cultural heritage and enhance the public's digital literacy, but also further improve the level of protection and utilization of cultural heritage. Through the integration of digital cultural heritage and education, the awareness of cultural heritage protection can be raised so that people can jointly guard the cultural treasures of all mankind.

Keywords: digital cultural heritage; sustainable education; cultural heritage preservation; university education

Introduction

Along with the development of digital technology and the transformation of the concept of cultural heritage protection, cultural heritage as a collaborative model for public participation and public education has emerged (Zhang & Dong, 2024). This not only provides a new solution to the shortage of resources, human capital and technical bottlenecks faced in the digital preservation and utilization of cultural heritage, but also provides an innovative approach to sustainable education (Beccherle & Lazzeretti, 2023). Sustainable education refers to the pedagogical practices, skills and strategies that promote lifelong learning both inside and outside the classroom (Reynolds et al., 2023). It is a wide range of learning practices, methods and strategies, and will be adapted to and meet the needs of different groups of students (Doukanari et al., 2021). With the help of digital cultural heritage, we can expand the paths of cultural, liberal and ethical education, and provide the public with diverse learning experiences such as participation and immersion.

In recent years, digital culture has been developing rapidly in China. In October 2022, the report of the 20th National Congress of the Communist Party of China (CPC) made an important deployment of “accelerating the construction of a digital China”. In March 2024, the work report of the Chinese government clearly put forward the specific requirements of “deeply promoting the national cultural digitization strategy” and “vigorously developing digital education”. Therefore, how to

Corresponding Author: Meng Chen
School of Architecture and Urban Planning, Shandong Jianzhu University, China
Shandong Provincial Research Center for Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, China
Email: chenmeng18@sdjzu.edu.cn

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utilize digital cultural heritage in quality education, higher education and public education has become an important topic. This paper examines the current status of research on the digital preservation and utilization of cultural heritage, and discusses the application paths and methods of digital heritage in sustainable education based on the current situation of education in China.

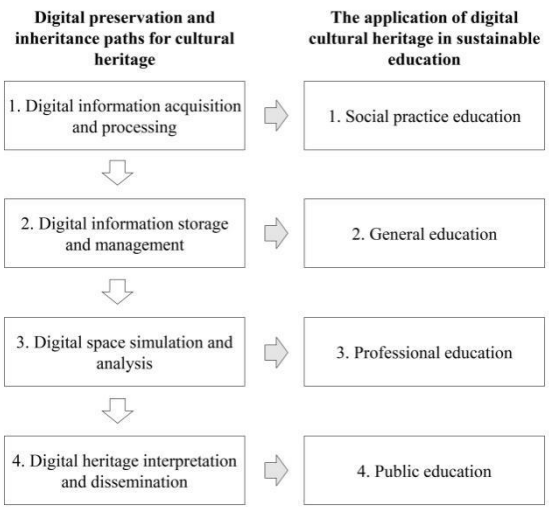
1. Research Review

Digital cultural heritage refers to the digital processing, integration and innovation of cultural relics and monuments using digital technology and informationization means in order to produce digital cultural products and related services. It includes digitalized spatial information acquisition, processing, storage, protection, interpretation and dissemination. Since the 1990s, the application of digital technologies and methods to the protection, utilization and inheritance of cultural heritage has become a worldwide research trend. Existing literature is mostly based on a certain aspect of digital technology to carry out applied research, such as the application of three-dimensional laser scanning, UAV tilt photogrammetry technology in the collection and management of information on cultural relics and monuments (Vosselman & Maas, 2010; Tang et al., 2011), the use of GIS and spatial syntax to carry out digital spatial analysis and virtual simulation (Louise et al., 2008), and the digital display, restoration and reproduction research based on the technical means of Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) (Abbott, 2017). Along with the increasingly diversified application of digital technology in the collection, analysis and utilization of information on cultural relics and monuments, there is an urgent need to construct a holistic and collective path and method to realize the in-depth integration of digital technology and methods and the protection of cultural relics and monuments.

The use of information technology in education is also an important research area. The digital transformation of education has inspired new thinking, new capabilities, new resources and new culture (Zhu & Hu, 2022). “Digital Ideological and political education” has become an important topic in China's education field in recent years. It is an efficient integration and utilization of ideological and political education resources based on digital technology, which is supported and driven by data elements to promote effective ideological and political education and improve quality and efficiency. Digital technology is then integrated into the ideological and political education system from multiple dimensions (Feng & Nie, 2023). Relevant research involves guiding students to experience the value of cultural heritage in virtual scenarios through virtual simulation (Zhang, 2023) and building a digital learning platform for cultural heritage (Li et al., 2022). Thus, the application of digital heritage in education has become an important topic. However, there is a need to further explore how to expand the application scenarios of digital heritage in sustainable education, so that digital heritage resources can be adapted to different types of educational activities.

This paper firstly studies the digital preservation and inheritance paths for cultural heritage, then it examines the application of digital cultural heritage in sustainable education, which includes social practice education, general education, professional education, and public education.

Figure1 Research Frame



2. Digital Preservation and Inheritance Paths for

Cultural Heritage

In order to integrate digital heritage into the whole process of sustainable education, the first step is to understand the paths and methods of cultural heritage digitization. Generally speaking, the digitization of cultural heritage consists of four aspects: information acquisition and processing, information storage and management, spatial simulation and analysis, and interpretation and dissemination.

2.1. Digital information acquisition and processing

Digital information collection of cultural heritage involves both unstructured and structured data. Unstructured data collection refers to the collection and organization of information based on local records, archives and historical documents to sort out important people and events and explore the stories behind cultural heritage. It also includes dynamic, three-dimensional text collection and recording of historical data through oral interview methods. Structured data refers to the collection of information on cultural heritage, which encompasses aspects such as artifact styles, forms, patterns, and details. For architectural heritage, it also involves information related to the preservation status, environmental features, architectural structure, spatial layout, materials and constructions, equipment and technologies, and building elements. Digital information collection often uses close-up photogrammetry, 3D laser scanning, UAV tilt photogrammetry and other technical means to comprehensively acquire all-round and high-precision information of heritage. Multi-directional data is integrated to complete a high-precision digital model of cultural heritage.

2.2. Digital information storage and management

The digital model of cultural heritage can express information such as element characteristics and value characteristics, and build a storage and management platform for cultural heritage. For architectural heritage, modeling software and information technology such as Revit and HBIM can be used to construct a component coding structure system. Through the coding function, the components are categorized, reflecting the characteristics and naming of the components. It can also clarify the number, location, existence form and relationship between the components of the building. For movable cultural relics, a digital management platform for cultural relics can be built based on digital technology to promote the archiving and management of cultural relics in different categories. Based on the structured description and classification cataloging of cultural relics, the classification of different periods and types of cultural relics can be built into a database to provide support for the preventive protection and antecedent protection of cultural relics.

2.3. Digital space simulation and analysis

Digital restoration and rehabilitation of cultural heritage can be realized by using digital technologies. Through CAD, Sketchup, HBIM and other technologies and 3D modeling means, it is possible to carry out digital restoration of the important heritage site that lacks effective protection or that has been improperly repaired, so as to reproduce the historical appearance of the heritage site. Utilizing spatial data such as location, boundary and attribute information provided by GIS, a comprehensive cultural heritage database can be constructed to facilitate long-term preservation and follow-up research. The landscape characteristics of cultural heritage can also be identified by using GIS methods such as grouping analysis, density analysis and landscape characterization. Following this, the distribution gradient of different periods and types of cultural heritage is generated, and the spatial and temporal aggregation areas of cultural heritage are identified. This also allows further visual layout analysis as a basis for cultural heritage tourism route planning and conservation planning.

2.4. Digital heritage interpretation and dissemination

Digital technology can realize the combination of online and offline digital display of cultural heritage. The use of VR, AR, MR, holographic projection and other technical equipment breaks

through the boundaries of time and space, enabling people to experience the cultural heritage of different regions without leaving home. Interpretation of cultural heritage in the form of video, animation, real-life reproduction, quiz games and other forms will enhance the attractiveness of cultural heritage in the form of activities that are popular among young people. For tangible cultural heritage such as architecture and landscape, digital technology can be used to build a combined online and offline interpretation network of cultural heritage, so that visitors can gain emotional resonance and identity through shared and empathetic digital narratives, and experience the charm of cultural heritage in an immersive environment.

3. Digital Cultural Heritage in Sustainable Education

Sustainable education requires that teaching content and activities meet the needs of different groups of students both inside and outside the classroom. How to expand the educational applications of digital heritage and realize the integration of different types of educational activities with the process of cultural heritage digitization is a key issue. The author believes that social practice, general education, professional education and public education can be carried out in conjunction with the process of cultural heritage digitization.

3.1. Social practice education

Practical social education for cultural heritage refers to a series of organized and planned activities aimed at raising public awareness of cultural heritage protection, cultivating their emotions towards cultural heritage, teaching relevant protection skills and promoting their active participation in the protection of cultural heritage. It not only focuses on knowledge and skills, but also emphasizes the importance of emotional development and public participation. Through this form of education, it can effectively raise the public's awareness of cultural heritage protection and promote the effective protection and transmission of cultural heritage. Cooperation between the relevant management organizations of heritage sites and primary and secondary schools and universities can be widely carried out to explore the path of integrating field research and current situation investigation of cultural heritage sites into social practice. Practical activities such as cultural heritage research and patriotic education can be carried out to form a combination of inquiry, investigation, visit and expedition. Students can expand their innovative horizons, improve their comprehensive literacy and cultivate patriotic feelings in the real-life scenarios of cultural relics and monuments. The materials, information and other contents of cultural heritage collected by various social practice activities can also promote the collection and processing of cultural heritage information, and constantly supplement and update the relevant data of digital heritage.

3.2. General education

The general education is an educational model that provides educated people with knowledge and values that are accessible to different groups of people (Harvard Committee, 2010). The general education usually covers a wide range of fields such as literature, history, philosophy, arts, natural sciences and so on. It is not limited to a particular specialty or skill training, but focuses on the overall development of students. Digital technology can be utilized to build a digital heritage case base, which can supplement existing curriculum resources, build teaching scenarios, innovate teaching methods, and combine with online knowledge quizzes to achieve teaching feedback. Relying on the relevant historical and cultural liberal arts courses, the application practice of digital heritage is carried out. Integrate digital teaching resources into the knowledge map of the course, and use AR and VR to build a visualized and scenario-based classroom. The digital heritage case library contains charts, mind maps and other forms, which can realize the enrichment of teaching resources, the innovation of teaching methods and the enhancement of teaching effects, forming a complete and intuitive knowledge system. This not only helps to improve students' cultural literacy and historical cognitive ability, but also stimulates their

patriotic feelings and sense of social responsibility.

3.3. Professional education

Professional education in cultural heritage is a comprehensive and interdisciplinary field. From the perspective of undergraduate majors, disciplines related to cultural heritage involve archaeology, museology, architecture, and urban and rural planning. From the perspective of teaching methods, it involves classroom lectures, flipped classrooms, field surveys, literature learning and other methods. Along with the development of digital technology, digital mapping methods such as 3D laser scanning, UAV tilt photogrammetry, and spatial technologies such as GIS, HBIM, and spatial syntax have begun to enter the field of professional education. The learning of technical methods related to digital heritage can also expand the path of case study and practical teaching in higher education institutions. Relying on the curriculum, the spatial analysis of cultural heritage in the region where the higher education institution is located should be carried out, so as to further excavate and interpret the value of regional cultural heritage. In addition, the application of digital heritage in the classroom should also be expanded by combining the characteristics of different disciplines. For example, for the specialty of architectural heritage conservation, digital heritage resources can be integrated into the curriculum from the dimensions of thematic embedding, invisible penetration, elemental fusion and innovative guidance, relying on the courses of historical building conservation design and urban historical and cultural heritage conservation. Digital reproduction based on historical situations creates a three-dimensional teaching scene, to promote the professional education.

3.4. Public education

The accessibility, interactivity and experience of cultural heritage can be improved through digital technology, realizing the purpose of promoting public education. This requires exploring the path of combining digital heritage with online and offline cultural experiences, innovating the form of cultural heritage narratives based on digital heritage, and constructing online digital museums. Digital heritage can also develop digital services such as intelligent guides and new media accounts, breaking through the limitations of geographic space and temporal space, and enhancing the transformation and utilization efficiency of heritage resources. The “digital individual” formed by the integration of digital technology and users will transform the public from passive recipients of cultural heritage to active explorers, spreading the story of cultural heritage in digital media and social platforms. The use of new digital narrative language and exhibition platforms breaks through the limitations of space and time. This will be an important way to tell the story of cultural heritage in the digital age, as the general public and cultural heritage are linked together.

Conclusion

The path and method of integrating digital heritage into sustainable education is a multidimensional and interdisciplinary topic, which involves how to realize the integration of digital heritage with different educational subjects inside and outside the classroom. This paper explores the complete path of digitalization of cultural heritage, including digital information acquisition and processing, information storage and management, spatial simulation and analysis, and heritage display and dissemination. It also explores the paths and methods of integrating cultural heritage into sustainable education, taking into account the basic demands of social practice education, general education, professional education and public education. The integration of digital cultural heritage into sustainable education can not only improve the public's digital literacy, popularize the knowledge related to cultural heritage and promote cultural identity, but also further improve the level of preservation and utilization of cultural heritage. Utilizing digital cultural heritage promotes cross-border and regional cultural exchanges and dissemination, and facilitates exchanges and understanding among people of different cultural backgrounds. It can effectively raise public awareness of cultural heritage protection and jointly safeguard the cultural treasures of all mankind. This is not only a sign of respect for history, but also a contribution to the future, helping to build a more harmonious, pluralistic and sustainable world.

Conflict of Interest

The authors declare that they have no conflicts of interest to this work.

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