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Cultural Identity in the Digital Realm: A Study of VR-Based Exhibitions for the Chinese Diaspora

Lina Li

University and school: Wuchang University of Technology
Address: No.16 Jiangxia Avenue, Wuchang, Wuhan, Hubei Province, China,
Phone number: 18071055236,
18071055236@163.com

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Abstract:
A range of technological methods offered by virtual reality creates favorable circumstances for multi-modal data input, which permits users to engage with computing systems via several natural sensory pathways, including sight, sound, and touch, thereby acquiring a feeling of deep immersion. This process enables the user to interact with elements in the simulated digital environment in a manner that more closely aligns with innate human interaction patterns. This research paper employs virtual reality technology to establish the foundational principles for planning a diaspora culture exhibition area, focusing on the three components of interactive features, technological platforms, and the physical layout. The governing principles that dictate the relationships between different spatial structures are systematically organized, the specific locations and dimensional proportions of various parts are established, the topological limitations are examined, and a finalized plan for these topological constraints is achieved. The structural layout for the exhibition space dedicated to overseas Chinese culture is automatically generated using VR technology, and the visual illumination and coloration within this space are subsequently enhanced using the Wallis filtering technique. Using overseas Chinese students from a specific mainland university as the practical case study group, the relevant investigative variables are scrutinized. Appropriate research propositions are put forward, and structural equation models are formulated to evaluate these propositions empirically. The composite reliability range is 0.906-0.945, and the average variance extracted is [0.736, 0.856], indicating that the model's convergent validity outcomes are strong. By applying the maximum likelihood estimation technique, a goodness-of-fit evaluation for the model is performed; both festival experience and cultural experience demonstrate a beneficial impact on cultural identity, with β values of 0.215 and 0.258 respectively, and P values of 0, signifying that the model exhibits a good fit following testing, that all the proposed hypotheses are supported, and that the diaspora culture exhibition space exerts a positive effect on the cultural identity of overseas Chinese..

Keywords: virtual reality technology; topological constraints; Wallis filter method; structural equations; diaspora culture exhibition space design

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1. Introduction

China's reform and opening up cannot be separated from the extensive support, enthusiastic participation and active dedication of overseas Chinese [1-2]. Domestic cultural and museum institutions at all levels have planned special exhibitions, academic seminars, and social and educational activities to commemorate the reform and opening-up, amid a hundred flowers blossoming and a hundred schools of thought contending for attention. The Overseas Chinese Museum is an important window into the history and culture of overseas Chinese [3-5]. How can we take practical action on the theme of the relationship between overseas Chinese and reform and opening up? On the one hand, to construct thematic exhibitions with overseas Chinese cultural relics to enrich, enrich and further prove the research results in this area, on the other hand, the existing research results will be presented in front of the audience with appropriate content and form, to give full play to the museum's public cultural service function [6-9].

Digital humanities, thanks to the popularization and application of digital technology in the field of science, provides new research methods and research paradigms for traditional humanities and social sciences research and teaching [10-11]. Strengthening the protection and development of cultural heritage and inheriting and promoting outstanding culture has become a universal consensus worldwide today [12]. Digital humanities advocates making full use of technologies such as digitization, data management and analysis, visualization, VR/AR and machine learning to re-engineer cultural heritage resources structurally, strengthen the correlation, accessibility, and visualization between the contents of heritage resources, enrich the presentation and depth of expression of heritage resources, and help the benign development and overall prosperity of protection and development work [13-15]. Overseas Chinese cultural heritage, also known as overseas Chinese cultural resources, is an emerging category of cultural heritage in recent years. Overseas-related cultural heritage encompasses both tangible and intangible cultural heritage, but as a category of cultural heritage with special nature and content, it should also include overseas-related derivative cultural heritage [16-18].

In order to promote the prosperity and dissemination of overseas Chinese culture and spirituality, and stimulate the cultural identity of overseas Chinese, it is necessary to conduct theoretical exploration and methodological practice on the protection and development of overseas Chinese cultural heritage from the perspective of digital humanities on the basis of in-depth research on the current situation of overseas Chinese cultural heritage resources, combined with research work in related fields at home and abroad, in order to provide useful reference for subsequent related protection, development, dissemination, and inheritance work [19-22].

Virtual reality technology has been applied in the museum exhibition design, but how to further explore the value of virtual reality technology in the museum, as well as to enhance the digital experience of the museum visitors is very worthy of deep thinking, so try to think about the optimization of the digital museum design path based on the museum staff, tourists' feedback and the actual case study and so on. Literature [23] discusses that the virtual museum, based on virtual reality technology, not only enhances the experience of tourists but can also be used as teaching material for culture and history and other subjects, enabling students to

play an active role in the relevant classroom through detailed explanations and actual cases. Literature [24] in-depth interviews with museum professionals on the views of virtual reality technology in the museum practice, aimed at assessing the feasibility of the application of VR in the museum cultural exhibitions from a professional perspective in all aspects of the museum's cultural exhibitions, and made a positive contribution to the advancement of the museum's VR program. Literature [25] introduces the cultural heritage exhibition project consisting of game-like exploration of 3D environments, virtual technology reconstruction with elements of digital fiction, and discusses in detail with two cases of VR practice in the Temple of Hera II Paestum as well as AR exploration of the Swimmer's Tomb, and argues that this model strengthens the degree of participation of the tourists, and also helps the tourists to understand the connotation of the cultural heritage deeply. Literature [26] analyzes the Viking VR exhibition in all aspects and discusses in depth the design of an authentic, rich experience of cultural heritage based on virtual reality technology, as well as the scheme for audience participation and interaction, which provides an important reference for the digital construction of cultural heritage information. Literature [27] examined public tourists' visiting experience of AR and VR technology-enabled museums based on a quantitative survey, combining correlation analysis, importance-performance analysis (IPA), descriptive statistics, and clustering analysis, which helps digital museums to optimize their AR as well as VR technological services, and to enhance tourists' experience of digital museums.

Overseas Chinese and China share the same roots and origins, and although they are always abroad, they still care about China's construction and development, so some scholars have examined problems related to Chinese cultural identity and how Chinese play a role in enhancing China's soft power. Literature [28] combined with a one-year tracking survey of transnational Chinese students, revealing that the rising nationalistic sentiment of Chinese going abroad for the desire for Western education has created Chinese entrepreneurs, who are the potential force for the economic construction and political revitalization of the new China, and the study points out that the experience of overseas mobility of the Chinese will strengthen the sense of national identity of the Chinese expatriates. Literature [29] discusses the rise of overseas Chinese heritage museums, based on the dismantling of Chinese diaspora culture, and deeply analyzes the ambivalence of Chinese diaspora heritage, including the complexity of transnational mobility and the production of heritage. Literature [30] explores the path of cultural identity identity reconstruction in the process of Chinese students returning to China to receive higher education, and argues that encouraging students to familiarize themselves with the language, awakening Chinese memories, and reshaping Chinese socialist values are some of the methods that can facilitate students' search for their identities and cultural memories. Literature [31] discusses the relationship between China's soft power and overseas Chinese compatriots, as well as the positive role played by overseas Chinese in enhancing China's soft power, which is of significant value to policy and research on overseas Chinese.

This paper proposes the direction of virtual exhibition space design guided by the object, combining the two directions of cultural theme and digital media art guidance, and dividing the underlying logic and design mode of diaspora culture exhibition space design into three aspects, which are based on interactive elements, technical carriers and spatial structure respectively. This paper unfolds the

introduction from the structural space. Using the REVIT platform, we formulate the constraint rules between structural spaces, determine the positions and sizes of components, and analyze topological constraints. Integrate all elements in the exhibition space for overseas Chinese culture, and at the same time call the model API to generate the component model based on the topological constraint relationships. At the same time, using the Wallis filtering method combined with the linear transformation formula, the gray value transformation of the exhibition space for overseas Chinese culture is carried out to complete the design. Through fieldwork, differences in the research variables are examined, relevant research hypotheses are proposed, and structural equations are used to verify the hypotheses.

2. Virtual Reality-based Exhibition Space Design for Overseas Chinese Culture

2.1 Object-guided design: efficient exhibition information and diversified virtual content

2.1.1 Cultural theme-led design

The cultural theme design gives the virtual exhibition space a narrative and historical character, so that the audience is in a “spatial and temporal environment” conducive to understanding the exhibits. Planners can get feedback from the audience's game behavior. For example, in the Nanjing Museum street scene, the space design is intricate but restores the historical appearance. From tourists' personalized dress and photo behavior, the audience can experience the unique cultural landscape of the Republic of China period. On the one hand, it earns profits through physical stores, and on the other hand, it visualizes the daily life of the Republic of China. The book "Nanjing Museum" says: "Cultural relics do not breathe, but there are immortal souls and lives that meet us through thousands of years", if archaeology can be regarded as the "first scene" of the initial exploration and discovery of civilization, museums and exhibitions are the "second scene" of the viewer entering civilization. Cultural theme guidance is an important form of object guidance, commonly used in history museums, non-heritage or folklore museums, the guidance mode is not a single cultural additions, but has a systematic, continuous, series of spatial presentation, relying on a certain cultural relics, a historical fact, a representative of the character to produce, create a series of sets of exhibitions (the creation of a subordinate, extension of the virtual theme gallery, digital video exhibition, historical street scene, etc.), to deepen the impression of the viewers and enhance the awareness of the audience.

2.1.2 Digital Media Arts Leadership Design

The exhibition design, guided by digital media and technology, enriches its externalized display performance and also stimulates the curiosity (“desire to explore”) and the “desire to win” of people of different ages. In the virtual exhibition need to “operate” the layout of the psychological curiosity, for example, Halifax Children's Museum through seven different themes of the garden composition, in the process of the game children in order to pass and try different props and ways, in the process of entertainment to understand the knowledge of natural geography and climatic phenomena in the museum opened a special spark gallery, the museum. The museum is constantly on the cutting edge of digitalization and technology. The content, which is updated every six months, is positioned as a

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high-tech, digitally interactive exploration and play exhibit. The curators of the Spark Gallery understand that traditional modular exhibitions alienate children. Therefore, the project is designed to attract visitors with innovative forms of "technology-guided interaction" and "science-logic games", aiming to bring children a sense of creativity and enjoyment through novel experiences. Each phase of Spark Gallery will introduce more than 10 interactive exhibition installations integrating educational significance, visual experience and science popularization value, covering virtual reality VR design, participatory coding, augmented reality AR design and other multifaceted technological means [32]. This chapter will discuss the design mode of the virtual exhibition from three aspects, namely, interactive elements, technical carriers, and spatial structure, and the final design is condensed into the design of "from line to surface" and "from field to domain", and its underlying logic and specific design methods (patterns) are shown in Figure 1.

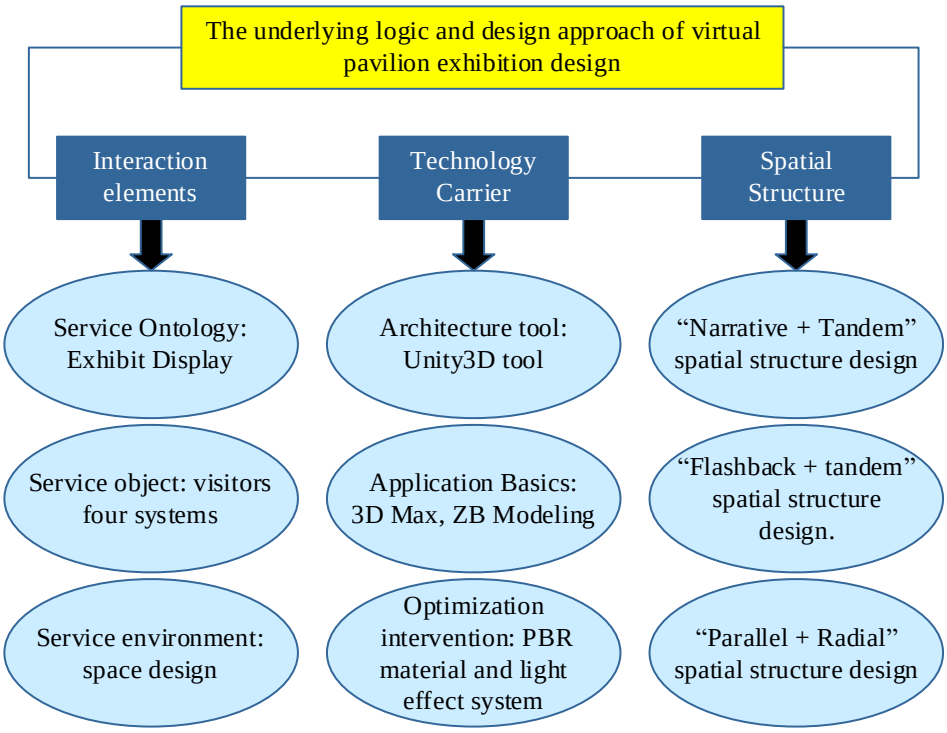

Figure 1 The underlying logic and the specific design

2.2 REVIT platform design

2.2.1 Structural spatial constraint relationships

Certain constraint rules must be satisfied between structural spaces so as to determine the location and size of different components. The topological constraints are analyzed.Topology is a collection of rules and relationships that can help the system model various geometric relationships more accurately. The detailed process is as follows [33].

(1) In the plane space, any node corresponds to a strut with specified plane coordinates. Let there exists m node in the plane space, and the topological constraint scheme C (with uniqueness) is obtained from the plane coordinates of these m nodes, i.e., [34]:

$$C = H(V) \tag{1}$$

$$V = \{(X_1, Y_1), (X_2, Y_2), \cdots, (X_m, Y_m)\} \tag{2}$$

(2) By traversing the whole scene, the adjacency and reachability between nodes are obtained from the node coordinates.

$$C_a = \{(a,b),(a,d)\} \tag{3}$$

For node e, its topological constraints can be described as follows:

$$C_e = \{(e,b),(e,d),(e,f),(e,h)\} \tag{4}$$

Based on the reachability between nodes, C_e is able to be reduced to:

$$C_e' = \{(b,h),(d,f)\} \tag{5}$$

2.2.2 Automatic Generation of Overseas Chinese Cultural Exhibition Space Structure

(1) Automatic pillar extraction

Determination of the plane position of each strut in each layer, that is, obtaining the two-dimensional center coordinates of the center of the strut cross-section.

(2) Automatic determination of the spatial position of beams and slabs

Based on the planar constraints, the starting spatial coordinate $P_1(x_a, y_a, z_a)$ and the ending spatial coordinate $P_2(x_b, y_b, z_b)$ are obtained for each frame beam in each floor.

(3) Automatic Determination of Beam and Slab Section Size

The dimensions of the frame beam $S = (h,l)$, the dimensions of the secondary beam $S^* = (h^*, l^*)$ and the thickness of the slab $S' = (r)$ are obtained from the dimensional constraints.

(4) Information collection of beam and plate models

1) According to the position information and cross-section dimension information of a frame beam, the information set of a frame beam is obtained, which is denoted by G here and described by the formula:

$$\begin{cases} G = \{P_1, P_2, S_{ize}\} \\ P_1 = \{x_a, y_a, z_a\} \\ P_2 = \{x_b, y_b, z_b\} \\ S = \{h,l\} \end{cases} \tag{6}$$

This determines the information set W for all frame beams, i.e:

$$\begin{cases} W = \{G_1, G_2, \cdots, G_N\} \\ G_1 = \{P_{R1}, P_{E1}, S_1\} \\ G_2 = \{P_{R2}, P_{E2}, S_2\} \\ \vdots \\ G_N = \{P_{RN}, P_{EN}, S_N\} \end{cases} \tag{7}$$

2) Iterate through each quadrilateral region surrounded by frame beams in the transition spatial information model of the entire exhibition building to obtain the information set of secondary beams in each region, which is described here by Eq. (10):

$$\begin{cases} G^* = \{P_1^*, P_2^*, S^*\} \\ P_1^* = \{x_a^*, y_a^*, z_a^*\} \\ P_2^* = \{x_b^*, y_b^*, z_b^*\} \\ S^* = \{h^*, l^*\} \end{cases} \tag{8}$$

$$\begin{cases} W^* = \{G_1^*, G_2^*, \cdots, G_N^*\} \\ G_1^* = \{P_{R1}^*, P_{E1}^*, S_1\} \\ G_2^* = \{P_{R2}^*, P_{E2}^*, S_2\} \\ \vdots \\ G_N^* = \{P_{RN}^*, P_{EN}^*, S_N\} \end{cases} \tag{9}$$

$$Q = \{W_1^*, W_2^*, \cdots, W_N^*\} \tag{10}$$

3) Based on the information of frame beams and secondary beams, find the 3D coordinates of the intersection points of the 4 beam axes in the quadrilateral region enclosed through the frame beams or secondary beams, and derive the thickness of the slabs from the dimensional constraints, and obtain the information of each slab, which is described by the formula:

$$\begin{cases} B = \{P_1, P_2, P_1^*, P_2^*, S'\} \\ P_1 = \{x_a, y_a, z_a\} \\ P_2 = \{x_b, y_b, z_b\} \\ P_1^* = \{x_a^*, y_a^*, z_a^*\} \\ P_2^* = \{x_b^*, y_b^*, z_b^*\} \\ S' = \{r\} \end{cases} \tag{11}$$

By traversing the individual quadrilateral regions supported by the beams, the information set of all the panels of the transitional space model of the exhibition building is obtained, described by Eq:

$$B' = \{B_1^*, B_2^*, \cdots, B_N^*\} \tag{12}$$

(5) Generate component model

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Iterate over all the elements in the collection and call the model API to generate the component model based on the topological constraints.

2.2.3 Light and Color Processing

In the process of three-dimensional simulation of the transition space of overseas Chinese culture exhibition, the results obtained will appear to a large extent the problem of large differences in light distribution and large differences in color, and need to be equalized to equalize the color processing.

The basic idea of Wallis filtering method is as follows: choose a reasonable template, based on the mean and variance statistics, correct the linear distribution of the target gray scale by Wallis filter. The linear transformation formula is as follows [35]:

$$f(u,v) = s(u,v)\delta_1 + \delta_0 \tag{13}$$

In Eq. (13), $f(u,v)$ is used to describe the gray value of the linearly transformed image located at (u,v), $s(u,v)$ is used to describe the gray value of the original image located at (u,v), and δ_0 and δ_1 are used to describe the multiplication coefficient and the addition coefficient in the representation of the linear transformation equation in turn, which can be determined by Eq. (14):

$$\begin{cases} \delta_0 = \varepsilon w_r + (1-\varepsilon) w_g \\ \delta_1 = \dfrac{\lambda q_r}{\lambda q_g + (1-\lambda) q_r} \end{cases} \tag{14}$$

If ε and λ are both 1, then the linear transformation can be described by the equation (15) is described [36]:

$$f(u,v) = \left[s(u,v) - w_g \right] \frac{q_f}{q_g} + w_f \tag{15}$$

3. The Impact of Overseas Chinese Cultural Exhibition Space on Overseas Chinese Cultural Identity

3.1 Research methodology

3.1.1 Research sample

In this study, Hong Kong, Macao, Taiwan and overseas students of a university in the mainland were used as the actual test subjects, 370 questionnaires were distributed, 360 questionnaires were recovered, of which 352 were valid questionnaires, with a recovery rate of 97.3%. There were 186 male samples and 166 female samples. There were 215 Hong Kong students, 50 Macao students, 53 Taiwan students and 34 overseas Chinese students. There were 114 freshmen, 35 sophomores, 103 juniors and 100 seniors. The details of the subjects are shown in Table 1 below.

Table 1 Study sample

Variable	Categories	Number	Percentage	Total
Gender	Male	186	52.84%	352

	Female	166	47.16%	
Biotically	HongKong	215	61.08%	352
	Macau	50	14.20%	
	Taiwan	53	15.06%	
	Overseas Chinese	34	9.66%	
Subject type	Human literature	36	10.23%	352
	Sociological department	243	69.03%	
	Engineering technology	73	20.74%	
Grade	Freshman year	114	32.39%	352
	Sophomore	35	9.94%	
	Junior	103	29.26%	
	Senior year	100	28.41%	

3.1.2 Research tools

(1) School Sense of Belonging Scale (PSSM)

The scale consists of 18 items on a linker six-point scale including six score bands, and the higher the subjects' scores, the stronger the sense of school belonging.

(2) General Self-Efficacy Scale (GSES)

The scale consists of 10 questions and is rated on a 4-point scale. The internal consistency coefficient of the questionnaire is 0.88, and the retest reliability is 0.85, with good reliability and validity.

(3) Perceived Social Support Scale (PSSS)

This scale is a social support rating scale that emphasizes individual self-understanding and self-feeling, containing 12 self-assessment items and using a 7-level scale. The internal consistency coefficient of the questionnaire is 0.95, and the internal consistency reliabilities of the subscales are 0.85 for family support, and 0.83 and 0.78 for friends' support and other support, respectively, which have reached the standard of psychometrics.

(4) Cultural Identity Scale

This questionnaire contains 9 questions and includes two dimensions: affective commitment and behavioral commitment. The combined reliability of this questionnaire is 0.88, and the reliability of the questionnaire is relatively satisfactory.

3.1.3 Procedures

The online psychological questionnaire was administered after obtaining informed consent from the students themselves. All data analyses in this study were processed using SPSS 26.0 for descriptive analysis, Pearson correlation analysis.

3.2 Analysis of research variables

3.2.1 Statistics of demographic differences between variables in the

(1) The effects of gender differences on Hong Kong, Macao and Taiwan students' sense of school belonging, self-efficacy, social support and cultural identity. Table 2 shows the effects of gender differences. In terms of gender differences, the mean scores of school belonging, self-efficacy, social support and cultural identity of male students were higher than those of female students. There is a significant difference between males and females in terms of self-efficacy, $p=0.0015<0.05$. Gender differences are not statistically significant in terms of school belonging, social support and cultural identity.

Table 2 Gender difference

/	Male(N=186)	Female(N=166)	T	P
School sense score	70.254±13.485	68.415±11.825	1.3487	0.1854
Self-efficacy score	73.458±10.521	69.818±8.821	3.4258	**0.0015*****
Social support rating	75.321±14.247	74.536±13.158	0.6048	0.5154
Cultural identification score	81.358±15.824	80.826±14.926	0.3478	0.7314

(2) The effects of differences in place of birth on Hong Kong, Macao, Taiwan and overseas Chinese students' sense of school belonging, self-efficacy, social support, and cultural identity.

Table 3 shows the effects of differences in place of birth, which categorized the subjects' place of birth into four categories: Hong Kong, China, Macao, China, Taiwan, and Overseas Chinese. In terms of school belonging, Hong Kong students (71.724) > Taiwan students (69.348) > Overseas Chinese students (64.625) > Macau students (62.315). Taiwanese students had the strongest self-efficacy and Macao students had the weakest self-efficacy. Hong Kong students received the highest social support. Regarding cultural identity, Hong Kong students (83.485) > overseas Chinese students (79.851) > Taiwanese students (78.965) > Macao students (74.526). Differences in place of origin were significant at $p<0.05$ for school belonging, social support and cultural identity, and not statistically significant at $p>0.05$ for self-efficacy.

Table 3 The difference of source

/	Hong Kong(N=215)	Macau(N=50)	Taiwan(N=	Overseas Chinese(N=34)	P

			5 3)		
School sense score	**71.724**±12.068	**62.315**±12.5548	**69.348**±13.6155	**64.625**±11.245	0.0000***
Self-efficacy score	72.158±9.715	70.254±9.325	72.485±11.6332	71.985±9.851	0.5925
Social support rating	76.265±13.158	69.715±14.9225	75.152±15.4999	75.124±13.485	0.0348**
Cultural identification score	83.485±13.956	74.526±17.3988	78.965±17.1655	79.851±15.369	0.005***

(3) The effects of professional differences on Hong Kong, Macao and Taiwan students' sense of school belonging, self-efficacy, social support, and cultural identity.

Table 4 shows the effects of major differences, which classified the subjects' majors into three categories: humanities, social sciences, and engineering technology. The results showed that students in social sciences had the highest ratings for school belonging (71.065), and students in engineering technology had the highest ratings for self-efficacy (72.785). Cultural identity was rated highest by students in social sciences and lowest by students in engineering technology with 82.647 and 77.835, respectively.The significance of $p=0.0035<0.05$ for school belonging score indicates that college major has a significant effect on this score, whereas the significance of $p>0.05$ for scores in self-efficacy, social support, and cultural identity was not significant.

Table 4 Professional differences

/	Human literature (N=36)	Social science(N=243)	Engineering technology(N=73)	P
School sense score	66.015±14.565	71.065±12.269	65.124±12.935	0.0035***

Self-efficacy score	70.659±8.965	71.885±10.556	72.785±8.425	0.5154
Social support rating	74.425±14.265	75.862±13.445	73.215±14.069	0.5985
Cultural identification score	81.965±14.136	82.647±14.498	77.835±17.569	0.0798

(4) The effects of whether or not to hold a position in a student organization on the sense of school belonging, self-efficacy, social support, and cultural identity of Hong Kong, Macao, and Taiwan students.

Table 5 shows the effects of whether or not holding a position in a student organization, which categorized whether or not the subjects had held a position in a student organization during their college years, and the results showed that students who served in student organizations had the highest sense of school belonging. Self-efficacy, social support, and cultural identity scores were also higher for students who served in student organizations. The $p=0.0032<0.05$ in the school belongingness scores, therefore, it was concluded that holding a position in a student organization had a significant effect on students' school belongingness. In the ratings of self-efficacy, social support and cultural identity $p>0.05$ is not significant and not statistically significant.

Table 5 Whether it is a student organization

/	Students work as organizations/ clubs	Students do not work as organizations/ clubs	T	P
School sense score	70.824±13.054	66.412±11.628	3.05	0.0032***
Self-efficacy score	72.265±10.598	71.305±8.754	0.78	0.4325
Social support rating	75.965±13.855	73.612±14.088	1.39	0.1647
Cultural identification score	81.265±15.987	80.365±15.574	0.16	0.8625

3.2.2 Correlation of variables

Table 6 shows the correlation analysis of each variable, Pearson correlation analysis of the questionnaire scores of school belonging, self-efficacy, social support and cultural identity of the subjects, the results show that cultural identity

is significantly and positively correlated with school belonging, self-efficacy and social support, social support is significantly and positively correlated with school belonging, self-efficacy and cultural identity, self-efficacy is significantly and positively correlated with school belonging, social support, and cultural identity were significantly positively correlated, and school belonging was significantly positively correlated with self-efficacy, social support, and cultural identity, with r of 0.3975, 0.4628, and 0.4958, respectively, and showed significant correlation at the 0.01 level.

Table 6 Correlation analysis of variables

Project	School sense score	Self-efficacy score	Social support rating	Cultural identification score
School sense score	1	0.3975**	0.4628**	0.4958**
Self-efficacy score	0.3975**	1	0.3945**	0.2514*
Social support rating	0.4628**	0.3945**	1	0.5098*
Cultural identification score	0.4958**	0.2514**	0.5098**	1

3.3 Main effects analysis

3.3.1 Research hypotheses and theoretical models

How to realize the model construction of cultural identity in thematic festivals remains an area to be explored, and the role of festival participants' cognition and experience on cultural identity deserves attention. The AIDA formula is originally a consumption model, the first "A" stands for Attention, which means to attract consumers' attention cognitively, "I" stands for Interest, that is, to arouse consumers' interest from perception, "D" stands for Desire, which means to promote consumers to have a sense of identity with the products sold from the behavior, and the last "A" stands for Action, which refers to the actual purchase behavior of consumers. This model has been used to analyze the process by which festivals present cultural heritage to participants and ultimately obtain feedback from them. In the Overseas Chinese Cultural Festival, college student participants have the first impression of the festival through the Overseas Chinese Cultural Exhibition Space designed in this paper, i.e., the attention stage, and in the course of the festival, participants are influenced by the cultural displays, interactive activities, and cultural and creative products, which generate subjective feelings about the Overseas Chinese culture, i.e., the interest stage. After the in-depth experience of the festival, the participants have an attitude of approval and recognition of the connotation of overseas Chinese culture, i.e. the stage of recognition. After experiencing the psychological process of approval or disapproval, participants feedback their psychological feelings through supportive

or unsupportive behaviors, such as recommending behaviors and sharing experiences, i.e., the behavioral stage.

In the context of the diaspora culture festival scenario, seven research hypotheses were proposed: H1 There is a significant positive effect of college student participants' perceptions of the festival on their perceptions of diaspora culture. H2 There was a significant positive effect of college student participants' festival perceptions on their festival experience. H3 College participants' diaspora cultural perceptions had a significant positive effect on their cultural experiences. H4 College student participants' festival experience had a significant positive effect on their diaspora cultural experience. H5 college student participants' festival experiences had a significant positive effect on their identification with diaspora culture. H6 College participants' diaspora cultural experiences had a significant positive effect on their cultural identity. H7 College participants' cultural identity had a significant positive relationship with their supportive behaviors.

3.3.2 Exploratory factors

Based on the results of the questionnaire, an exploratory factor analysis (EFA) was conducted using SPSS 26.0 software on the 21 question items of festival awareness, cultural awareness, festival experience, cultural experience, cultural identity, and supportive behaviors to derive the eligible evaluation dimensions. AMOS 28.0 software was used to conduct a validation factor analysis of the observed variables, which was mainly divided into convergent validity and discriminant validity tests, and structural equations were constructed to test the hypotheses.

The festival perception measures encompassed knowing about the Diaspora Cultural Festival, knowing the location of the Diaspora Cultural Exhibition space, and aspiring to participate in the Diaspora Cultural Festival. Cultural awareness encompasses understanding the uses of diaspora culture, knowing the cultural implications of diaspora culture, and understanding the cultural meanings of diaspora culture. The festival experience included the beautiful design of the Diaspora Culture exhibition space, the feeling of relaxation and fulfillment from participating in Diaspora Culture, the combination of traditional and virtual technology at the Diaspora Culture Festival, and the cultural exchange and interaction of Diaspora Culture that immersed me. The cultural experience includes excavating the multicultural characteristics of overseas Chinese culture, demonstrating the rich forms of application of diaspora culture, shaping cultural symbols of diaspora culture to enhance cultural influence, and promoting diaspora culture by combining campus culture and contemporary diaspora culture. Cultural identity includes that the festival made me realize the value of diaspora culture, the festival created a sense of active learning about diaspora culture, the festival made me willing to participate in the transmission of diaspora culture, and the festival made me love the campus more. Supporting characterizations are: willingness to learn more about diaspora culture, willingness to introduce diaspora culture to others, and hope that the diaspora culture festival will continue to be held so that more people can experience it.

Table 7 shows the exploratory factor analysis. Since the process of festival cultural identity is still in the exploratory stage, the principal component analysis and the maximum variance method in SPSS 26.0 software were applied to extract and rotate respectively, and the criteria of factor loadings lower than 0.4 and cross loadings greater than 0.4 were used as the basis for the question item deletion. The

preset question items all meet the requirements, and we obtained six public factors composed of 21 question items, which can correspond to the six dimensions of festival cognition, cultural cognition, festival experience, cultural experience, cultural identity, and supportive behaviors, respectively, with a total of 85.835% of the variance explained, and the Cronbach's α coefficients of the six public factors are all greater than 0.9, which indicates that the internal consistency of each factor is is strong, the research reliability is high, and the structural validity between each variable and its constituent indicators meets the requirements of empirical analysis.

Table 7 Results of exploratory factor analysis

Dimension	Measuring index	Factor load	Interpretation variance /%	Explain the variance accumulation /%	Cronbach's α
Section cognition	FC1	0.9421	12.9254	12.9254	0.9345
	FC2	0.9264			
	FC3	0.9354			
Cultural cognition	CC1	0.8564	11.9354	25.8508	0.9025
	CC2	0.8751			
	CC3	0.8763			
Incident test	FE1	0.8428	15.3154	41.1662	0.9158
	FE2	0.8915			
	FE3	0.8425			
	FE4	0.8525			
Cultural experience	CE1	0.8966	15.3265	56.4927	0.9182
	CE2	0.8325			
	CE3	0.8425			
	CE4	0.8325			
Cultural identity	CI1	0.8715	16.5269	73.0196	0.9436
	CI2	0.9036			
	CI3	0.8915			
	CI4	0.8715			
Supporting behavior	SB1	0.8956	12.8154	85.835	0.9428
	SB2	0.9126			
	SB3	0.8945			

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3.3.3 Validation factor analysis

Table 8 shows the validation factor analysis to assess the model fit, and the overall fit of the CFA model was $x^2/df = 1.264$, GFI = 0.926, CFI = 0.978, NFI = 0.945, and RMSEA = 0.0426, with all metrics meeting the criteria. The convergent validity of the measurement model requires that the standardized factor loadings should be above 0.5 and reach the level of significance, the combined reliability (CR) interval is between 0.906 and 0.945, which is greater than 0.7, and the average variance of the distillation (AVE) interval is [0.736,0.856], which is greater than 0.5, and the results of the convergent validity test show good results.

Table 8 Verification factor analysis

Dimension	Item	Parameter significance estimation		Convergence validity	
		Std.	T-value	CR	AVE
Section cognition	FC1	0.951***		0.945	0.842
	FC2	0.815***	22.899		
	FC3	0.924**	24.526		
Cultural cognition	CC1	0.892***		0.906	0.778
	CC2	0.912***	18.388		
	CC3	0.812***	15.625		
Incident test	FE1	0.893***		0.915	0.736
	FE2	0.964***	21.958		
	FE3	0.806***	16.018		
	FE4	0.761***	14.685		
Cultural experience	CE1	0.875***		0.914	0.738
	CE2	0.861***	18.359		
	CE3	0.771***	14.502		

	CE4	0.876***	17.816		
Cultural identity	CI1	0.886***		0.944	0.815
	CI2	0.915***	21.065		
	CI3	0.903***	20.339		
	CI4	0.901***	20.264		
Supporting behavior	SB1	0.901***		0.945	0.856
	SB2	0.976***	25.364		
	SB3	0.896***	21.459		

3.3.4 Distinguishing validity analysis

Table 9 shows the analysis of discriminant validity, the discriminant validity between the table variables was measured using the square root of the AVE of each factor, the Pearson correlation coefficients of this factor with the other factors were greater than the AVE of each factor, and the factor Pearson correlation coefficients were 0.917, 0.875, 0.853, 0.815, 0.905, and 0.925, respectively, which indicated that the data discriminant validity was good.

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Table 9 Discriminant validity analysis

Factor	A	Section cognition	Cultural cognition	Incid	Cultural experience	Cultural identity	Supporting behavior
Section cognition	0.	**0.917**					
Cultural cognition	0.	0.175**	**0.875**				
Incident test	0.	0.153*	0.264***	**0.853**			
Cultural experience	0.	0.087	0.318***	0.341	**0.815**		
Cultural identity	0.	0.248***	0.324***	0.276	0.271***	**0.905**	
Supporting behavior	0.	0.146*	0.307***	0.263	0.395***	0.248***	**0.925**

3.3.5 Hypothesis testing

Based on the test of reliability and validity, structural equations were utilized to test the research hypotheses. The fit test of the model using the maximum likelihood method showed good fit ($x^2/df=1.756$, CFI=0.963, GFI=0.0.901, NFI=0.936, RMSEA=0.063), with the composite fit index and relative fit index reaching the standard of excellence, and the GFI and RMSEA reaching the standard of goodness of fit. The model showed that the path coefficients all reached significance, indicating that all seven hypotheses proposed were valid. As shown in Figure 2, festival perceptions had a significant positive effect on cultural perceptions (β = 0.205, ρ = 0.003), and festival perceptions had a positive effect on festival experiences, with β and P equal to 0.189 and 0.008, respectively. Cultural awareness and festival experience had a positive effect on cultural experience, with β of 0.358 and 0.325, respectively, and P of 0. Festival experience and cultural experience had a positive effect on cultural identity, with β of 0.215 and 0.258, respectively, and P of 0. Cultural identity had a positive relationship with supportive behavior.

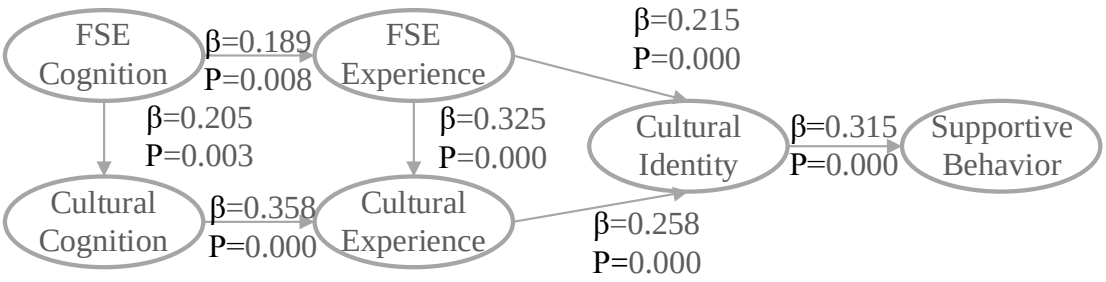

Figure 2 Hypothesis test results of research structure model

4. Conclusion

This paper designs a diaspora culture exhibition art space using the REVIT platform with a cultural theme and digital media art guidance as the core. The constraint relations of the diaspora culture space are defined, and the structure of the diaspora culture exhibition space is automatically generated. In the process of 3D simulation of the diaspora culture exhibition space, Wallis filter method is used to deal with the light and color of the diaspora culture exhibition space. Through the empirical study, the variables were statistically analyzed in terms of demographic differences, and there was a significant difference between males and females in terms of self-efficacy, $p=0.0015<0.05$. Among the differences in place of origin, Hong Kong students had the highest cultural identity of 83.485, followed by overseas Chinese, Taiwanese and Macao students, with cultural identity of 79.851, 78.965 and 74.526, respectively.Research hypotheses were formulated and structural variance was constructed to validate the relevant research hypotheses. An exploratory factor analysis of the model showed that the total of the six male factors explained 85.835% of the variance and the Cronbach's alpha coefficients were all greater than 0.9. Using the maximum likelihood method to fit the model, the path coefficients of the model all reached significance, and festival perceptions had a significant positive effect on cultural perceptions, β = 0.205 and ρ = 0.003. Festival experience and cultural experience had a positive effect on cultural identity, with β of 0.215 and 0.258, respectively, and P of 0. All seven hypotheses proposed were valid.

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