

Research on Experiential Education Strategies for Middle School Students Based on Multimodal Theory

--A Case Study of T'ien-kung Museum

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Abstract

This paper focuses on the exhibition space experience design of T'ien-kung Museum and explores the development and strategy research of multimodal theoretical design for experiential education of middle school students. Through interviews with five middle school students, their understanding and experience of the museum are obtained. The KJ method is used to group and classify the interview information to analyze the research results and identify the existing problems in detail. The need for experiential education by middle school students in museums is clarified. To enhance the experience and educational dissemination of museum space, interactive projections based on the T'ien-kung Museum are created, interactive devices are triggered, and simulation models are used to restore historical scenes and other spatial experience forms. These strategies highlight the importance of multimodal theory for museum cultural space experience design and promote the development of museum experiential space education communication function.

Keywords

"T'ien-kung" museum space, multimodal theory, middle school student education, experiential design.

1. Introduction

A museum serves as a condensed repository that embodies the history and culture of a city or region. It is a public space that showcases regional cultural characteristics and humanistic spirit, while also promoting regional culture, national spirit, and historical education knowledge[1]. With the change of times, the educational function of the "T'ien-kung" Museum has become increasingly valued. However, the traditional form of museum display space experience and relatively single exhibition forms have limited the application of immersive displays, smart exhibition halls, and virtual exhibition hall experience spaces[2], particularly for middle school students who are in the stage of growth and learning. The "T'ien-kung" Museum's collection resources can help improve students' learning and innovation abilities[3]. Therefore, this study integrates multimodal theory into internal space design to enhance the experience function of spatial diversity and fun. Through the combination of visual, auditory, tactile, and other multi-sensory spatial forms, this research provides innovative experiences that optimize knowledge and design levels for middle school students.

2. Multimodal Theoretical Design of Experience Space of "T'ien-kung" Museum

2.1. The concept of multimodal theory

Multimodal theory incorporates various sensory inputs, including external factors such as light, sound, and smell, acting on the human sensory system and the nervous system that processes respective signals. The modalities include visual, auditory, tactile, olfactory, and taste [4].

Visual experience is crucial in museum space, as the color, lighting, size, and placement of exhibits can impact people's visual experience [5]. Color usage, its comfort and contrast, can affect visitors' emotions, with comfortable colors providing a pleasant viewing experience. Bright or too dark lights can reduce the display effect of exhibits.

The auditory experience can focus visitors' attention in the museum space and enhance their memory through sound stimulation of the brain. The museum space requires a relatively quiet environment, and sound insulation is adopted in many places in the wall design to avoid other noises affecting the viewing process [6].

The sense of touch can enhance visitors' experience in the museum space. However, many exhibits in the "T'ien-kung" Museum are placed inside glass cabinets, limiting visitors' interaction with the exhibits and the space's resonance [6].

2.2. The status quo of the experience space of the "T'ien-kung" museum

In recent years, there have been various research efforts made by scholars on the experiential space of the "T'ien-kung" museum. For instance, Li Hui [7] and other scholars created a narrative-themed immersive image space, a holographic interactive pavilion, a cultural and creative center, and a planetary theater in the "T'ien-kungkaiwu" museum. Scholars Jin Xiaoyi [8] combined traditional handicrafts and virtual scene plates in the experience design of the Folk Art Museum of China Academy of Art. Zheng Li [9] and other scholars studied the exhibition form of the "Su Yi T'ien-kung" museum using a survey method. Tang Xinxing [10] and other scholars investigated the five-sense experience design and its educational function in Chinese museums. Additionally, Wang Chunfa [11] conducted research on museum experience forms such as cloud viewing, remote interaction, and intelligent push. These studies show that the application of multimodal theory in the "T'ien-kung" museum is gradually becoming more extensive. It is also evident that the form of space display has a direct impact on the visitor's experience, and education is receiving more attention in museum design.

3. The research method and analysis of the "T'ien-kung" museum space on the current situation of experiential education for middle school students

3.1. Research method interview method

The interview method is used to directly communicate with middle school students in order to gain an in-depth understanding of their experiential education in museum space design, as well as to explore their experience needs when visiting museums. The research process involves conducting interviews with five local middle school students, aged between 13 and 16 years old, for a duration of 30-40 minutes. To meet the research objectives, ten interview questions are set. These flexible questions are designed to explore different situations and guide communication with the students to obtain information on their needs when visiting the "T'ien-kung" Museum. The students are also asked about their ideas and future expectations for the museum's exhibition space design, and the relevance of multimodal theory and experiential education for middle school students is further explored.

3.2. Analysis method of research results——KJ method

The KJ method, also known as the A-type diagram method and the affinity graph method, was developed by Dr. Kawakita Jiro, a professor at the Tokyo Institute of Technology, in 1964. It is a method for building consensus that enables the rapid display of all the information present in everyone's mind, organizing the data based on consensus, and identifying the root of the problem[12]. This method can be used to clarify the current situation of museum display space and the experiential education needs of middle school students. Its application can provide valuable insights for the next stage of the research project.

Been to Suzhou Museum, not impressed	Saw showcases and art exhibitions	There are lecturers and teachers explaining in the museum	See static exhibits, but see dynamic exhibits	Don't like book-based learning, like visiting learning
Haven't paid attention to the exhibition experience space of the museum	I hope that the future display will be interesting and can participate in it	Interactive Experiences Deepen Memories	Visited museums around the school	The interior space is large and spacious
There is a narrator	The order of exhibits is arranged according to the timeline	Divided into various exhibition halls according to the types of exhibits	The display forms are cabinet and wall-mounted	Exhibits are mainly viewed visually
The showcase against the wall is not conducive to viewing exhibits around	Diversified display spaces can deepen the impression of exhibits	Don't like to read, like to learn by playing	Freestanding display, immersive display, holographic image	Not Understanding Modal Design
Haven't seen the space of VR display	The museum has interactive equipment and rich experience space	Frequent visits to museums with parents during holidays	The museum is a display of local history and culture	The quality of museums directly affects students' learning attitudes
I visited the museum, and it was neatly arranged inside.	Video display, text display, showcase display, mural	Some museums have video and picture displays	Exhibition experience space can stimulate the desire to visit the exhibition	Book-based learning will distract, like practical learning
Experience an interactive exhibit, touch the screen to change colors	Hope to have more immersive experience space	After class, you will learn about things you are interested in in the museum	Museum showcases local cultural history and city history	Museum helps teens learn about history
Visiting the exhibition can gain a lot of knowledge	There are many styles of exhibits	When you go home, you can only view the photos and review the exhibits and spaces	want souvenirs or miniatures	Book-style learning can't imagine the appearance of the real thing
Looking forward to a more intelligent display experience space	Visited the specimen museum	The museum can see the appearance and texture of small animals	Small scenes in the interior of the space	In the specimen museum, you can only see but not touch
There are display cabinets and display panels	The form of space display guides visitors to the exhibition process	Do not understand immersive exhibition hall, smart exhibition hall	love experiential learning	Museum design integrates diverse experience spaces

Figure 1 Paper making

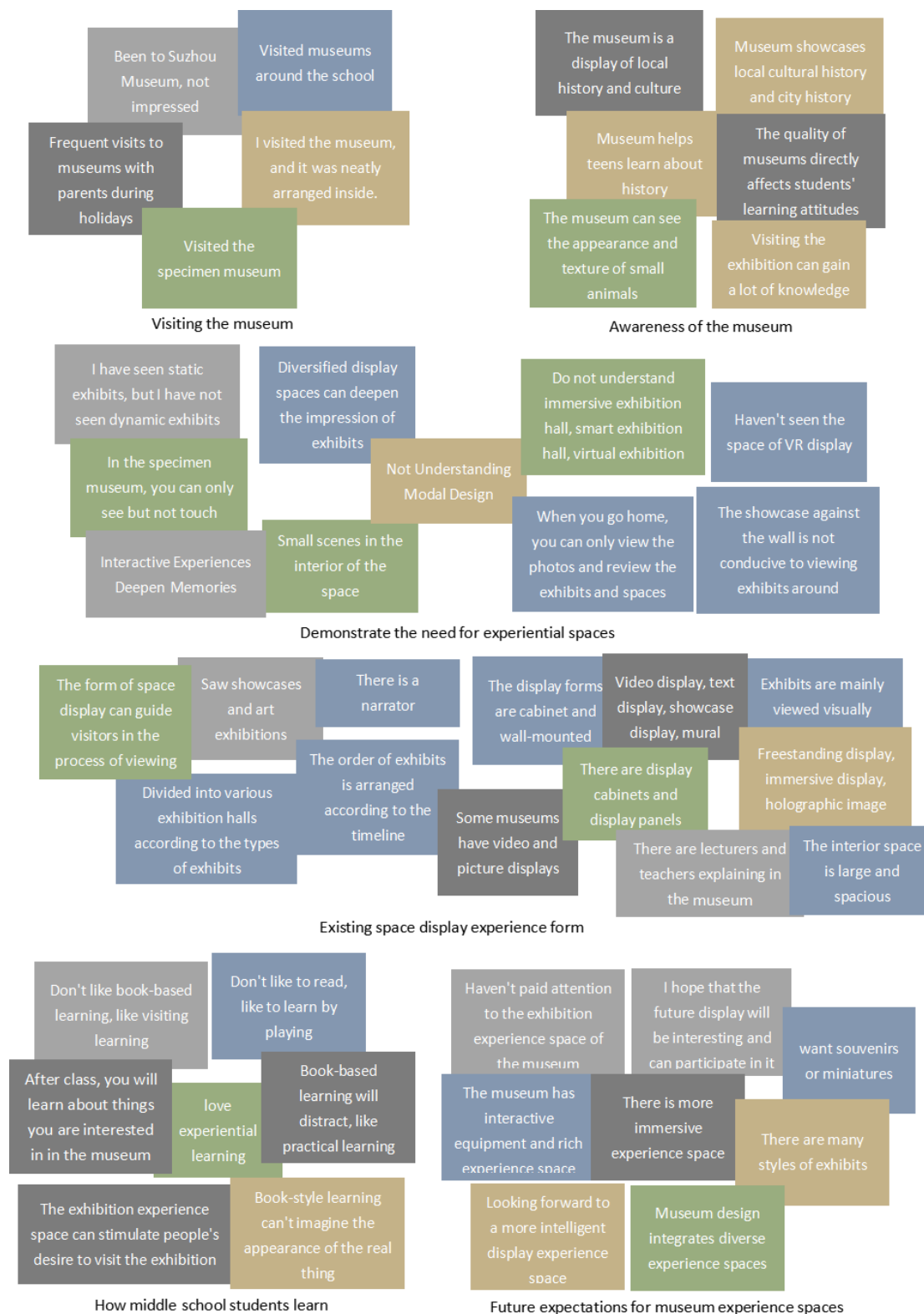


Figure 2 Group classification

After conducting the interviews with the middle school students, the obtained information was analyzed and organized. The main information extracted was presented visually in Figure 1, and the pieces of information were classified and summarized according to their similarities, as shown in Figure 2. These classifications were then grouped into several categories, each starting with a general title that highlighted the lack of museum display experience space and the need for the development of experiential education for middle school students. Based on the information collected through the classification process, the reasons for these needs were

summarized, as shown in Figure 3. Finally, the needs of middle school students for museum experience space were clarified.

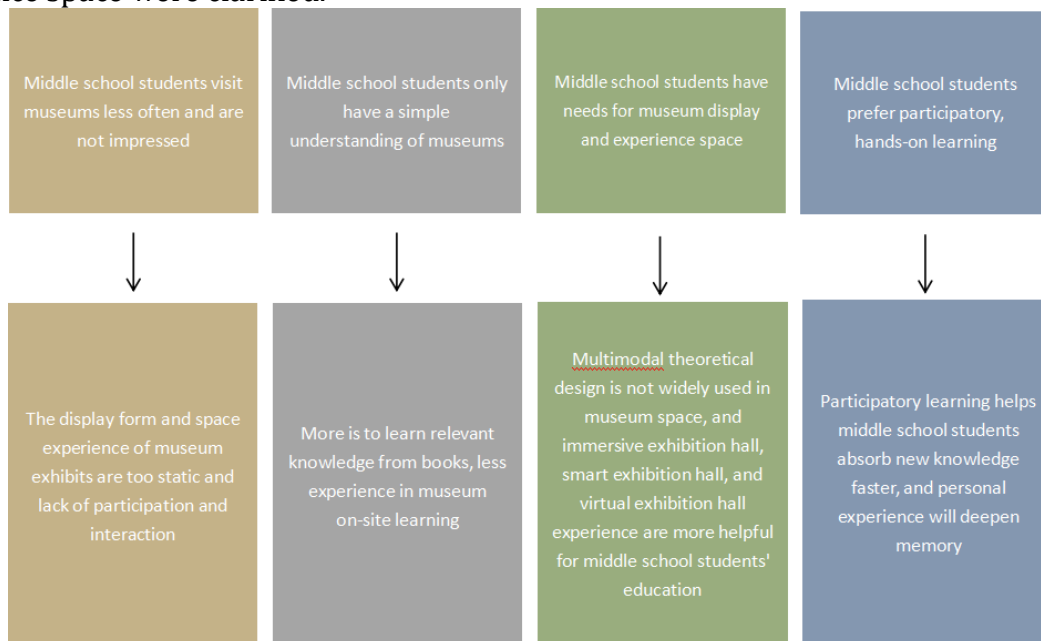


Figure 3 summarizes the reasons

3.3. Cause Analysis of Existing Problems

First, through the research and analysis of middle school students' museum visits, it is concluded that middle school students visit the "T'ien-kung" museum less often, and are not deeply impressed by the contents and exhibits. This phenomenon is due to the fact that the display space and form of the exhibits in the "T'ien-kung" museum are too static. During the visit, you can only appreciate the exhibits through visual observation, or understand the exhibits through the text and picture explanations on the wall display boards, and you cannot touch the exhibits at close range. Difficulty interacting with exhibits and display spaces.

Second, middle school students have a relatively shallow understanding of the "T'ien-kung" Museum, and they only have a simple understanding, knowing that it is a display of local cultural history and urban history, but the educational significance of the "T'ien-kung" Museum for middle school students has not yet reached a comprehensive level. The reason is that middle school students learn more about historical knowledge and historical relics from books, and the "T'ien-kung" Museum has less on-site learning experience. When visiting the exhibits, they can't associate with the knowledge of books, and they can't feel the strong historical background when they see the space atmosphere. Therefore, it is more difficult to combine the book knowledge learned with the exhibits of historical relics.

Third, the existing display space of the "T'ien-kung" museum that middle school students understand is relatively traditional, and there is more demand for display and experience space. The multimodal theory is not widely used in the space design of the "T'ien-kung" museum. Since middle school students are in the learning stage of nine-year compulsory education, most of the time is book-based learning. Students will feel tired and bored with text explanation and display. In addition, the spatial display form of the "T'ien-kung" museum is simplistic, static and regular, and the layout is simple and boring, which cannot provide interesting and diverse forms of experience for middle school students; the educational communication methods of the "T'ien-kung" museum are relatively ordinary, and most of them The culture is spread in the way of direct narration and stereotyped reading by the staff, ignoring the interaction between middle school students and the display space to acquire knowledge, which tends to make middle school

students lazy to think deeply and reduce their desire to explore unknown things, and it is difficult to mobilize the middle school students' enthusiasm positivity.

Fourth, compared with the traditional teaching mode, middle school students prefer participatory and practical learning methods. For students, participatory learning helps to absorb new knowledge faster, truly feel the fun of the exhibition space atmosphere, and experience the smart lights and colors of interactive equipment, which can deepen students' memory of new knowledge and new culture.

4. The strategy of applying the multimodal theory of "T'ien-kung" museum space to the development of experiential education for middle school students

4.1. Interactive projection and triggering interactive device equipment to enhance middle school students' visual, auditory and tactile experience

The "T'ien-kung" museum's exhibition space design incorporates interactive devices such as interactive projection and virtual imaging to create an engaging interactive environment. These devices capture images of the user's movements, generate motion patterns, and combine the data with a real-time image interaction system to create new images that respond to the user's movements. The devices also emit various sound effects to enhance the information interaction between middle school students and the devices, constantly generating new experiences.

In addition, the accompanying space background is designed to complement the effect presented by the interactive equipment. Through touch, middle school students activate the interactive devices, and the combination of visual and auditory stimuli captures their attention and creates an engaging interactive experience. Different actions produce unique visual and auditory effects, with constantly changing sound effects and informational content. The presented images and sounds stimulate the senses of middle school students, attracting them to establish a deeper connection with the exhibits and gain a greater understanding of the historical information and cultural context. The use of interactive projections and devices enhances the overall experience of the "T'ien-kung" museum space, allowing middle school students to easily access cultural information and enjoy the interactive display.

4.2. Using simulation models to restore historical scenes to promote the education and dissemination of "T'ien-kung" museum

Restoring historical scenes through simulation models is an effective way to convey the theme and connotation of exhibits at the "T'ien-kung" museum. By designing simulation models that accurately recreate specific events from different periods, and incorporating relevant T'ien-kung culture, historical figures, environment, and decorative backgrounds, visitors can more intuitively understand the exhibits' historical significance. To enhance the experience, a narrow passage can be used to design historical scenes in chronological order, with lighting effects created using ancient kerosene lamps, candles, and flashlights, and simulated character models of historical figures to create an immersive atmosphere.

During the visit, middle school students can experience the restored historical scenes through touch and vision, gaining a more realistic understanding of the historical stories learned in books. Immersing themselves in these scenes, they can gain insight into the hardships and struggles of historical figures, and appreciate the importance of cherishing their learning and life in the present. This approach enhances the experiential quality of the "T'ien-kung" museum's display space and promotes cultural education and dissemination.

4.3. The combination of multi-angle surround screen projection technology and "T'ien-kung Culture" historical appliances enhances the cultural atmosphere of the museum

The use of multi-angle ring-screen projection technology combined with historical equipment in the "T'ien-kung Culture" exhibit space not only enhances the museum's display experience but also brings visitors closer to the exhibits. Firstly, multiple fixed projectors are installed in the open area, creating a huge multi-angle screen display system that accurately and vividly displays historical relics and cultural backgrounds, providing a strong visual impact on middle school students. By placing visitors in the center of the scene, they can be fully surrounded by the entire cultural scene, allowing them to truly and comprehensively understand the "T'ien-kung" historical artifacts and historical culture in detail. Secondly, by integrating the "T'ien-kung Culture" appliances with real scenes and using multimedia to configure sound effects and lighting, a virtual historical and cultural atmosphere can be created. This allows visitors to experience the application of various historical artifacts through sight and sound, enhancing their imagination and innovative thinking. Finally, using the correct 3D image display, visitors can intuitively experience the size, function, and value of the historical artifacts, creating an immersive space atmosphere through sight and sound, stimulating the interest and enthusiasm of middle school students. This approach lays a strong foundation for the continuous design of the "T'ien-kung" museum's cultural experience space, providing a unique and engaging cultural experience for visitors.

4.4. Create a farming experience space to increase the dissemination of "T'ien-kung culture" through the personal experience of middle school students

The "T'ien-kung" museum has created a farming experience space that integrates farming tools and environments into the design. Low-fidelity scenes of wheat and rice sowing are set up, allowing middle school students to experience the farming process and feel the challenges of farming life by touching and using the farm tools. This highlights the importance of "T'ien-kung culture" and enriches the museum's display space experience. The farming experience space enables middle school students to understand how to spread farming skills and culture, promoting further learning and inheritance of "T'ien-kung culture".

5. Summary and Outlook

As an important location for historical and cultural display and storage in China, the "T'ien-kung" Museum has been receiving increasing attention for its internal space design. The traditional approach of passive viewing exhibitions is no longer sufficient to meet the needs of students. Multimodal theory plays a crucial role in enhancing space experience, and its application in the "T'ien-kung" Museum's space experience design is becoming more widespread. By using interactive projections, simulation models to restore historical scenes, and multi-angle ring-screen projection technology to design the exhibition space of the "T'ien-kung" Museum, the museum enhances the sensory experience of middle school students, allowing them to acquire new knowledge quickly and deepen their memory of exhibits and their cultural connotations. This creates a multi-sensory experiential space in the "T'ien-kung" Museum display, promoting the development of museum experience space education and communication functions.

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