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Creating Informal Learning in Ocean Museums in China: A Case of Shenzhen Shekou Aquarium

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Abstract

Enhancing informal learning through technology in museums is a relatively underdeveloped concept in China. This paper aims to investigate the potential of incorporating technology into ocean museums to facilitate informal learning from the perspective of an educator. The background of the museum and the existing challenges are discussed in detail, followed by the selection of suitable technologies and their rationale. The major theories guiding this approach are immersive learning, learning by doing, and productivity orientation.

Keywords: China context, informal learning, ocean museum, physical experience, technology

1. Introduction

Chinese ocean museums have unique opportunities to promote ocean literacy and environmental awareness through the creation of informal learning opportunities. Informal learning can provide engaging and memorable experiences for visitors, as well as reach a wider audience who may not have access to formal education. It allows for a more accessible approach to education, as it does not require formal classroom settings or structured lessons, which makes it easier for a wider range of people, including children, adults, and those with diverse learning abilities, to engage with and learn from museum exhibits and displays.

Research supports the value of informal learning in museums, particularly in promoting environmental education (Ballantyne & Packer, 2005). According to Falk and Dierking (2018), informal learning can foster a deeper understanding and appreciation of environmental issues. Moreover, studies have shown the effectiveness of interactive exhibits in enhancing ocean literacy education in Chinese museums specifically (Andre et al., 2017; Stocklmayer et al., 2010; Ying et al., 2017). Chinese museums are home to a rich cultural heritage that spans thousands of years. Informal learning opportunities in museums help to preserve and promote this cultural heritage by allowing visitors to learn about Chinese history, art, and traditions in a hands-on and interactive manner.

In this paper, the author will explore the importance of creating informal learning opportunities in the Chinese ocean museums in the case of Shenzhen Shekou Aquarium and the impact of it, which can have on promoting ocean literacy and environmental awareness. The author will also discuss how to integrate technology to create more effective informal learning opportunities and the potential benefits for both visitors and the museum itself.

1.1 Background of the Institution

The Shekou Ocean Museum is a prominent museum located in Southeast China, boasting 270 physical specimens, and divided into four themes that focus on marine ecology, shellfish marine life, aquatic ecological civilization, and fish. To showcase the wonders of marine life, the museum uses modern technologies such as sound, light, electricity, and Virtual Reality (VR) demonstrations.

As a historical landmark of Shenzhen's marine culture, the Shekou Marine Museum creatively integrates the historical and cultural significance of old Shekou with the modern and liveable construction of new Shekou. The museum's concept of marine protection aims to enhance public awareness of ocean protection and ecological preservation.

1.2 Its Goals of Creating Opportunities for Informal Learning

Open access for everyone. This ocean museum serves as a platform to promote marine biology knowledge, raise awareness for marine protection, and encourage humans to coexist harmoniously with the ocean. It caters to visitors of all ages, providing various educational designs to facilitate learning, from the youngest toddlers to the

elderly. Through its situated experiences, the museum has become a comprehensive education hub with a focus on regional characteristics and marine science knowledge to achieve its educational objectives.

Proper guidance. The museum provides guidance for visitors to navigate the exhibitions and learn about marine life from knowledgeable staff. According to Savin-Baden's (2008) cognitive theory, knowledge acquisition is a dynamic process that involves understanding the nature of knowledge and learning how to interact with different perceptions of the world, which can be facilitated through guidance and social interaction. Through this guidance, visitors can engage in informal learning experiences.

Concise and explicit narration. The museum has made efforts to provide visitors with educational materials even without the assistance of staff. Each exhibit features easy-to-read information that provides visitors with a basic understanding of the marine creatures on display. This allows visitors to explore the exhibits and learn at their own pace, making the museum a valuable resource for self-guided learning. Moreover, this self-guided learning experience can foster a sense of autonomy and self-directed learning, which are essential skills for lifelong learning.

2. Challenges in Facilitating Informal Learning

The Shenzhen Shekou Ocean Museum is facing complex and fascinating challenges in facilitating informal learning due to several factors.

Unpleasant visitor experience. Despite providing easy-to-read information about each creature, the museum faces the problem of overcrowding, which can lead to negative perceptions among visitors. Studies have shown that visitors tend to have negative perceptions when experiencing a crowded situation (Schmidt & Keating, 1979). Furthermore, statistics reveal that only 36% of the museum's space is used for displaying exhibits, despite the considerable Chinese population (Ren & Zhai, 2013). These factors contribute to creating an unpleasant experience for visitors, hindering informal learning opportunities in the museum.

Few chances for interaction. The marine museum currently lacks opportunities for interaction, particularly for the most curious visitors, children. The limited number of docents available makes it difficult for visitors to engage with the exhibits beyond watching and listening. Additionally, there is a lack of tactile experiences as visitors are unable to touch the exhibits or access more detailed information beyond the simplified introduction cards. This limits their ability to fully immerse themselves in the world of marine knowledge. Dong et al. (2011) found that out-of-school programs are often supervised by teachers, which restricts students' ability to explore marine knowledge independently and limits opportunities for interaction. To address these challenges, knowledgeable guides who can provide a high-quality experience for visitors are essential.

Moreover, little research on informal learning in Chinese museums. The lack of emphasis on informal learning in Chinese museums and educational institutions is a missed opportunity for promoting lifelong learning and self-directed exploration of natural sciences. Informal learning has been found to be primarily focused on problem-solving and self-direction, with a more holistic perspective on the subject (Degner et al., 2021). However, the significance of informal learning is often difficult to evaluate tangibly in the short term, which may discourage teachers from promoting or cultivating it. Moreover, there is limited research on how to effectively create informal learning opportunities in non-educational institutions such as museums in China (Gong, 2022; Han et al., 2020), stressing the necessity of further exploration and growth in this region.

3. Goals of the Investment

Hence, if possible, by utilizing the author would like to achieve the following goals through informal learning in this museum setting:

First, create a more comfortable and technology-based environment for visitors' possible informal learning. According to Perrot (2000), museums, especially public ones, have shifted towards the customer-driven concept, acknowledging the importance of meeting visitors' needs. Visitors often complain about the museum's actual conditions, such as extreme temperatures, high humidity levels, and a lack of resting places. Such factors can negatively impact visitors' experiences, and they may shorten their time spent at the museum. Therefore, it is crucial to create a favorable environment with technical support that facilitates learning and discovery.

To further increase visitors' engagement and interaction with exhibits, incorporating interactive technologies like augmented reality or virtual reality can be beneficial. Knowledgeable guides can also be provided to assist visitors in their exploration and discovery. In various recreational contexts, the quality of the experience is largely determined by the atmosphere, as noted by Chang & Horng (2010). Thus, creating an atmosphere that is engaging and conducive to learning can significantly enhance visitors' experiences and increase the time they spend at the museum.

Second, acknowledge and reward visitors' achievements in the informal learning setting to strengthen their learning experience. Open-ended tasks, including problem-based challenges and hands-on science activities, can be particularly effective. Offering rewards to those who succeed can sustain their learning motivation. As noted by Paris (1997), physical engagement in solving challenges can lead to a feeling of pride and satisfaction, which can increase interest, perceived confidence, and self-worth in future work.

Moreover, immersive and experiential learning activities can enhance visitors' understanding and appreciation of marine life and the importance of marine conservation. These activities can help visitors connect with the exhibits and the larger context of marine life. Such experiences can include interactive exhibits, live demonstrations, and educational programs. These activities can provide visitors with a deeper understanding of the marine environment and inspire them to take action to protect it. Overall, creating a learning environment that values and rewards visitors' achievements and offers immersive learning experiences can greatly enhance their learning outcomes and foster a sense of connection and responsibility toward marine conservation.

Third, encourage more professional practitioners, teachers, educators, technological experts, and scientists to be the creators or organizers of the informal learning activities. Developing and implementing educational programs and activities cater to the diverse needs and interests of visitors, including children, families, and adults. According to Meyers et al. (2013), designing informal learning activities should be contextual, incentive, and perceivable, intended to support and foster self-efficacy. It is important to create learning activities that are interesting and relevant to visitors' lives, as some activities may decrease interest in the museum visit. Therefore, stakeholders' awareness of informal learning plays a crucial role in designing activities that incorporate technology for better learning outcomes.

Establishing partnerships with schools and other educational institutions to promote the integration of informal learning activities into the curriculum and encourage lifelong learning can help museums reach a broader audience and provide more opportunities for visitors to engage in informal learning experiences. By working together, museums and educational institutions can create a more comprehensive and cohesive learning environment that supports visitors' learning and development.

Finally, monitor and evaluate the dynamic learning process and long-term influence of visitors' informal learning in this museum. This can be achieved by conducting research on the effectiveness of informal learning in museums and tracking the growth and development of participants over time. As suggested by Henderlong and Paris (1996), monitoring the participants' growth can make a significant difference in maintaining the development of the museum. It is essential to consider not only the tangible creations made by the participants but also the skills they have acquired, like collaboration and problem-solving, self-regulation, and a sense of pride and satisfaction in their achievements. These skills can be valuable for visitors' future studies and can motivate them to return to the museum.

By evaluating the effectiveness of informal learning programs, museums can identify areas for improvement and make necessary changes to better serve their visitors. This can help museums achieve their educational goals and create a learning environment that engages and inspires visitors to learn and make a difference in the world.

4. The Technologies Chosen

China Digital Ocean Prototype System (CDOPS)

According to Zhang et al. (2011), there have been worldwide attempts to enhance ocean observation and data sharing, including the Integrated Ocean Observing System, Google Earth, and KML generators like Yasuko. One particular project, CDOPS (Liu et al., 2009), has caught the attention of the author, who wishes to invest a grant in it. The following is its framework of it:

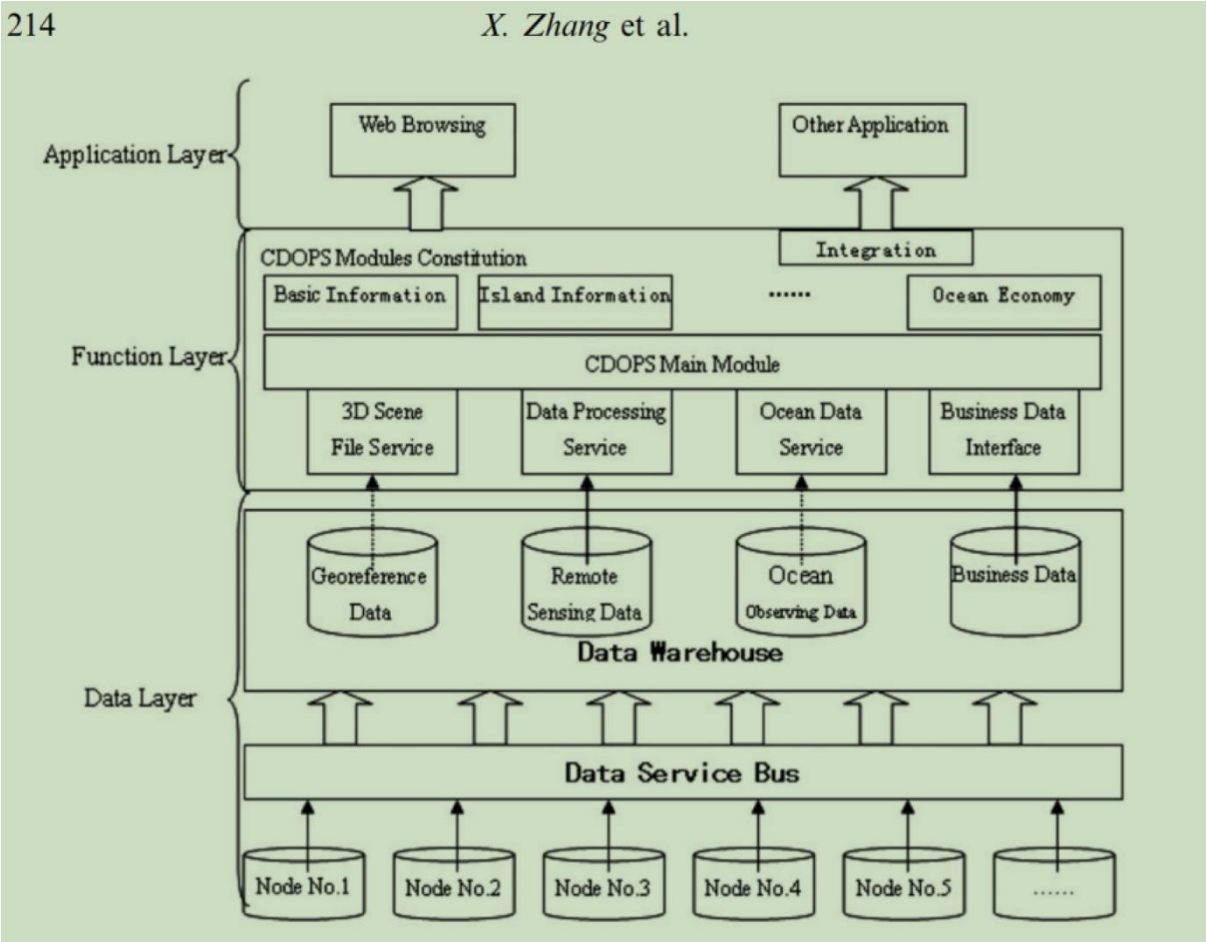

Figure 1. The framework of CDOPS

CDOPS, unlike China Digital Science and Technology Museum (CDSTM), is designed to facilitate genuine interactions instead of solely relying on online interactions (Dong et al., 2011). Liu et al. (2009) described CDOPS as a system supported by technology that accepts the analysis, evaluation, and manipulation of ocean data through visual visualization. This technology is similar to Skyline's TerraSuite software.

CDOPS offers a wealth of educational information, including videos showcasing marine life and past unseen ocean explorations that users can access. Additionally, the system offers opportunities to cultivate knowledgeable commentators.

Geographic Information System (GIS)

The interactive 3D VR platform supported by GIS can offer the public access to fundamental geographic and dynamic marine data, as well as sea spatiotemporal data (L ü et al., 2019). Malczewski (2004) demonstrated that GIS could efficiently communicate and interact with non-spatial databases, statistical software, spreadsheets, and graphical programs, allowing data and information to be transferred between programs. This integration of spatial analytic models, planning, and decision-making processes with GIS systems has facilitated more effective decision-making and planning in various fields.

Experiencing the museum at one's own pace is not just about navigating from one point to another. Informal learning in museums is less structured than in school settings, which can stimulate interest and involve visitors in innovative ideas and situations that they can relate to their prior experience and understanding (Roberts & Lyons, 2017; Roppola, 2013). Therefore, the center of informal learning in the museum should focus on how visitors navigate the exhibits theoretically, attentively, perceptually, and physically. The visitor experience is not just about physical movement but also about creating mental and physical pathways through the exhibition that enhance engagement and understanding.

Overall, the proposed technology investment includes CDOPS and GIS, which will be supported by a 3D VR platform, mobile devices, and a multi-user virtual environment (MUVE) (Laws et al., 2009).

5. Rationales for the Technologies Chosen

Aiming to solve the problems in the museum, facilitate informal learning, and maintain the ocean museum's sustainable development, the author takes advantage of the significant function of the technologies.

Providing abundant knowledge database. Falk and Dierking (2018) recommended involving visitors in the exhibition and considering the physical, personal, and social contexts. The CDOPS technology is an excellent tool for providing visitors with sufficient scientific learning materials to satisfy their desire for exploration. Zhang et al. (2011) indicate that CDOPS covers a wide range of resources and objectives, including various data models. Specifically designed for ocean data management and analysis, CDOPS enables more accurate and efficient processing of marine data. This technology supports better tracking and management of ocean data, enabling users to monitor changes and trends in the marine environment.

Additionally, GIS technology can help create models or visualizations based on dynamic data (Malczewski, 2004), which is the foundation of the learning context, as explained further by Roppola (2013). GIS technology allows for the integration of spatial data and non-spatial data, enabling the creation of more sophisticated and accurate models and analyses. This technology can support better decision-making processes by providing a more comprehensive view of the data and enabling users to explore relationships and patterns that might not be immediately visible.

Cultivation for digital literacy. The 3D VR platform offers the public an opportunity to interact with exhibits by creating their own samples, utilizing information acquired through VR observation and prior experiences and abilities. This platform provides an immersive and visually appealing experience for users, enabling them to explore and interact with ocean data in a more engaging and meaningful manner. Studies have revealed the efficiency of this technology in improving learning outcomes and promoting engagement among users.

This allows visitors to learn from the CDOPS database according to their interests and curiosity. Kotler et al. (2008) suggested that museums should offer opportunities for contemplation, play, excitement, and learning. Immersive virtual reality systems have been shown to be effective for historical research, simulation, and reconstruction and have both educational and entertaining functions (Roussou, 2000). Additionally, using technology helps cultivate visitors' skills in digital literacy.

Offering the physical experience of anticipation. 3D printers provide visitors with the opportunity to touch and interact with exhibits instead of just observing them through the glass. Similarly, MUVEs enable visitors to immerse themselves in different environments, promoting collaboration and social learning among users. This interactive and dynamic technology can facilitate deeper learning and knowledge sharing among users. Roberts and Lyons (2017) suggest that MUVEs can offer novel activities for exploratory learning. Additionally, Oblinger (2004) highlights the numerous educational benefits of hands-on activities and games. Recent advancements in MUVEs have focused on providing a 3D platform that visitors can personalize based on their interests. Laws et al. (2009) found that visitors can create websites reflecting their interests, attracting others with similar interests, and facilitating verbal interactions that promote informal learning.

However, engagement in virtual reality environments is not solely about exploration. Dunleavy et al. (2009) note that problem-solving as a team, facilitated by the immersive experience and social interaction, can promote the transfer and generalization of skills and knowledge.

Facilitating dynamic interaction. Visitors can enhance their learning experience by using their own mobile devices or ones provided by the museum to access further information about the exhibits through QR codes. When scanned, the codes connect to the GIS system, which provides relevant details visually and dynamically. This activity allows for interaction between individuals or groups, including adults and children. According to Johnson and Crowe's (2009) cognitive mapping theory, learners can identify the structure of the problem and the stimuli for learning by following designed signs and achieving goals. The experiment conducted by Mikalef et al. (2013) demonstrated that using interactive mobile devices improved visitors' performance on tests.

Presenting tangible production. To encourage visitors to apply what they have learned from the museum, the CDOPS website provides an open-access platform where they can share their knowledge and win free tickets to the museum. Visitors can upload videos, audio, documents, and photographs, which reflect the outcomes of their learning (Paris, 1997). This technology aims to engage visitors in the process of consumption, production, and participation, leading to tangible outcomes and motivation (Helsper et al., 2015). Mobile devices let users get information and data from anywhere, at any time. This technology can support more flexible and convenient learning experiences, enabling users to engage with ocean data and information on their own terms.

6. Conclusion

In conclusion, museums have the potential to offer rich and engaging learning experiences through the use of technology, such as CDSTM, GIS, 3D VR platforms, mobile devices, 3D printers, and MUVE. These technologies provide visitors with a range of interactive and personalized learning opportunities, including exploration, problem-solving, and hands-on learning. By integrating open-access websites and social media platforms, visitors can share their experiences and contribute to the museum's community, increasing motivation and interest in future visits. The incorporation of technology in museums enhances the educational experience for visitors, enabling them to gain a more profound understanding and appreciation of the exhibits on display.

To promote informal learning, two pedagogies have been invested in, namely the Please Do Touch approach (a hands-on method) (Kucharčík et al., 2016) and Learning from Experience with an Object (learning by doing) (Dewey, 1904; Jůva, 2004; Van Mensch & Meijer-van Mensch, 2011). The technologies chosen are based on five rationales. However, it is important to consider workplace relationships and capacity issues, and further research is required to investigate effective methods for promoting informal learning in Chinese museums.

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