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Public Environmental Science Popularization through Innovative Interactive Artistic Experiences

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Abstract

Water scarcity and pollution are global challenges. Under the guidance of green development principles, China has made significant progress in ecological protection and Yangtze River conservation. However, water pollution remains a pressing issue. Raising public awareness, particularly among teenagers, about water resource conservation is a critical aspect of environmental science popularization in China. Based on expert interviews and public surveys, the study identified the following challenges: 1) low frequency and weak sustainability of public participation in science popularization activities, which rely heavily on administrative promotion; 2) lack of artistic, interactive, and participatory elements in these activities; and 3) high public enthusiasm for environmental protection that current science popularization activities fail to meet. The innovative initiative involved designing science popularization exhibits using waste materials such as discarded clothing and plastic bottles, presenting them in artistic and interactive forms to convey scientific messages. This approach attracted approximately 50 offline visitors and 104 online viewers via live streaming, with 75 satisfaction surveys collected. Results showed: 1) a 94.67% satisfaction rate; 2) artistic visual effects, interactivity, and novelty as the most appreciated aspects; and 3) exhibit quantity, venue layout, and exhibit themes as areas for improvement. This innovative practice enhanced students' environmental awareness, promoted resource recycling, and stimulated audience interest and practical action in water resource conservation.

Keywords

Science Popularization Activities, Artistic Design, Environmental Protection, Water Resource

1. Introduction

Public water resource science popularization is one of the key objectives outlined in important documents and policies such as the China Water Resources Strategy Research. Effective public education on water resources can help the public, especially young people, understand the current state of China's water resources, enhance societal awareness of water conservation, and promote the concept of sustainable development. Additionally, research has shown a negative correlation between public environmental emotions and sense of responsibility and corporate environmental pollution levels [1]. Enhancing public environmental awareness contributes to the establishment of more eco-friendly social habits and strengthens social oversight.

However, current public science popularization activities predominantly rely on one-way information dissemination, lacking artistic appeal, interactivity, and engagement, making it difficult to stimulate public interest and participation. This study aims to integrate artistic creation with scientific knowledge through an innovative interactive art experience. By utilizing recycled materials, an art-based science exhibition on water resource conservation will be designed to present China's water resource status, the challenges it faces, and water-saving practices. This approach seeks to inspire students' awareness of water conservation and motivate them to take concrete actions, thereby advocating for the concept of resource recycling and further deepening and broadening environmental education.

Based on questionnaire surveys, interviews, and literature research, this study explores the potential of enhancing public engagement through art-infused interactive science popularization activities. Using a successful art-based science exhibition as a case study, the research analyzes its design, implementation, and reception, aiming to provide new pathways for future science communication practices.

2. Essential Research

2.1. Literature Review

Enhancing science education on ecological and environmental issues for adolescents and expanding the creation of environmental science communication content are among the eight primary tasks and five key enhancement actions outlined in the 14th Five-Year Plan for Environmental Science Popularization Implementation [2]. These initiatives are concrete actions guided by the Outline of the National Action Plan for Scientific Literacy (2021-2035) issued by the State Council.

Along the Yangtze River Basin, numerous urban clusters—such as the Yangtze River Delta, the Middle Yangtze River urban agglomeration, the Chengdu-Chongqing urban cluster, the Jianghuai urban cluster, the Central Yunnan urban cluster, and the Central Guizhou urban cluster—play a crucial role in China's economic development and population mobility. These clusters encompass over 50 prefecture-level cities and exhibit strong economic vitality. According to 2019 national economic data, their combined Gross Domestic Product (GDP) accounted for ap-

proximately 34% of the national total. This highlights the significance of Yangtze River ecological conservation for both regional and national economic development.

In recent years, various government departments have implemented a series of protective and restorative measures in response to issues such as pollution, water resource management, and biodiversity conservation in the Yangtze River. Notably, the Ten-Year Fishing Ban on the Yangtze River has been one of the most direct and effective measures for ecological protection and is considered a key benchmark for the success of conservation efforts [3]. However, water ecological issues in the Yangtze River Basin remain pressing. Pollution remains largely concealed, public awareness of water conservation is insufficient, and the management of domestic and industrial wastewater pollution remains ineffective [4].

Plastic pollution in the Yangtze River Basin is also a critical concern. However, China's monitoring system for plastic waste remains underdeveloped, with significant gaps in fundamental data and numerous regulatory challenges. For instance, Taihu Lake, one of the most significant freshwater lakes in the Yangtze River Basin, suffers from severe microplastic pollution. Studies indicate that the abundance of microplastics in its inflowing waters far exceeds levels found in the 29 tributaries of the North American Great Lakes, the Yangtze Estuary, and the Three Gorges Dam [5].

On the other hand, the textile industry is the world's second-largest polluting industry after petroleum. The environmental damage and water pollution caused by this sector have long been overlooked by the public. China, which accounts for one-third of the world's textile and apparel exports, has an industry that constitutes over 50% of the global textile market [6]. A 2024 study on carbon emissions from more than 30 Chinese textile enterprises revealed that between 2003 and 2022, the industry's carbon overload rate increased annually, placing significant environmental pressure on Chinese textile manufacturers [7].

2.2. Expert Interview

To gain insight into the current implementation of science popularization efforts, this study conducted a remote interview with Zhao Xi, a senior environmental science educator at the Xicheng Science and Technology Museum in Beijing. The discussion covered topics such as environmental pollution and climate change impacts, case studies on water conservation education in schools and communities, and the current state of microplastic pollution. This exchange helped clarify the significance and direction of the research team's initiatives.

With the promotion of the national green development strategy, public awareness of environmental protection has been steadily increasing. However, continuous science education efforts are necessary in schools, as environmental issues are constantly emerging and require interdisciplinary knowledge. During the interview, the expert introduced the concept of "Dao, Fa, and Shu" in youth environmental science education:

●**"Dao" (道):** Understanding the environment and pursuing harmony between humans and nature. This involves shifting human attitudes toward nature from dependence to influence and ultimately to adaptation.

●**"Fa" (法):** Defining the objectives of environmental education—whether it aims to directly change the environment or to gain public recognition and support.

●**"Shu" (术):** Implementing effective methods while avoiding ineffective approaches such as symbolic pledges and signatures.

The case study discussion on the concept of "water footprint" provided inspiration for the final design of the artistic exhibits in this research.

Furthermore, the expert offered the following suggestions for this study:

1. Ensure scientific accuracy in science popularization content. Information should be sourced from government websites, industry research reports, professional textbooks, and academic journals, such as those from the National Development and Reform Commission, the Ministry of Natural Resources, the Ministry of Ecology and Environment, the Ministry of Water Resources, and the National Bureau of Statistics. Search engines should be used cautiously.

2. Incorporate artistic elements into science communication. While some artistic approaches have been applied in teacher training programs within schools, they are still relatively rare in public science museums and exhibition spaces. Artistic interaction can be an effective way to engage younger audiences.

3. Conduct thorough audience research to ensure that the exhibition design aligns with the age and professional backgrounds of the target audience.

2.3. Public Attitudes Toward Current Water Conservation Science Communication Activities

To understand public attitudes and expectations toward current water conservation science communication activities, this study conducted an online survey. The questionnaire was divided into five sections: 1) Level of concern for environmental issues, 2) Satisfaction with existing activities, 3) Practical impact on daily life, 4) Areas for improvement, and 5) Expectations for this study's proposed science communication initiative.

A total of 170 responses were collected. Among them, 70 respondents (14.18%) had never participated in any water conservation-related science communication activities. After excluding these responses, 100 valid responses were analyzed in the study.

To understand public attitudes and expectations regarding water conservation science communication activities, this study distributed an online questionnaire. The survey consisted of five sections: 1) Level of concern for environmental issues, 2) Satisfaction with existing activities, 3) Practical impact on daily life, 4) Areas for improvement, and 5) Expectations for this study's proposed science communication initiative.

A total of 170 responses were collected. Among them, 70 respondents (14.18%)

had never participated in any water conservation-related science communication activities. Therefore, the remaining 100 responses were considered valid for analysis.

1. The public has access to various forms of science communication, but continuity is weak and heavily reliant on administrative initiatives.

Survey results indicate that the public engages in a variety of science communication activities, with lectures, courses, and outdoor publicity campaigns being the most common. This suggests that, driven by national green development initiatives, various social institutions have provided the public with a diverse range of science communication activities. (Figure 1)

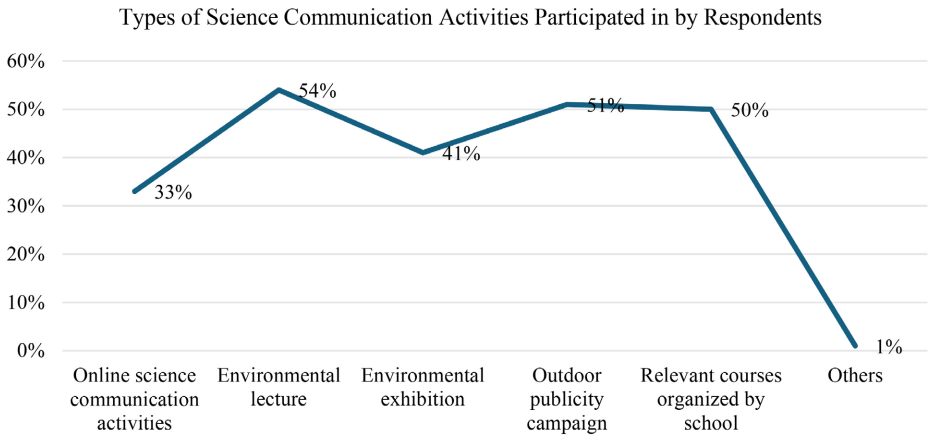
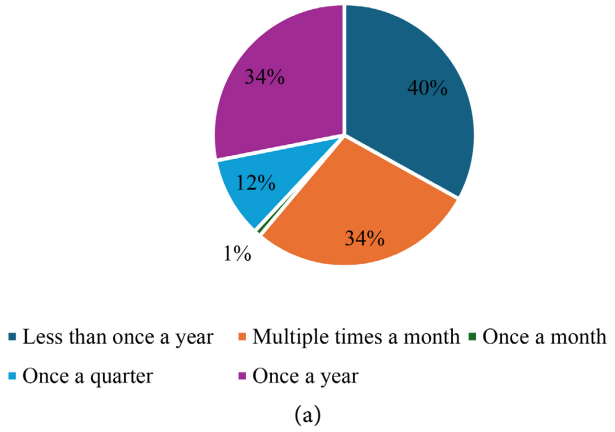


Figure 1. Types of science communication activities participated in by respondents.

However, it is worth noting that when asked about the frequency of participation in science communication activities, 74% of respondents indicated that they participate only once a year or less. Such a low frequency is far from sufficient for continuously updating their knowledge.

The survey also found that school and workplace administrative notifications are the primary channels through which the public accesses science communication activities, accounting for 65%. In addition, social media promotion is another major source of information for public engagement in such activities. (Figure 2)



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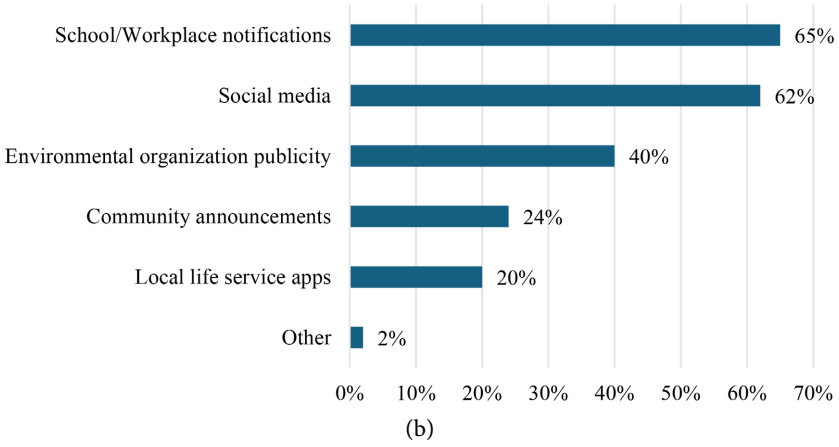
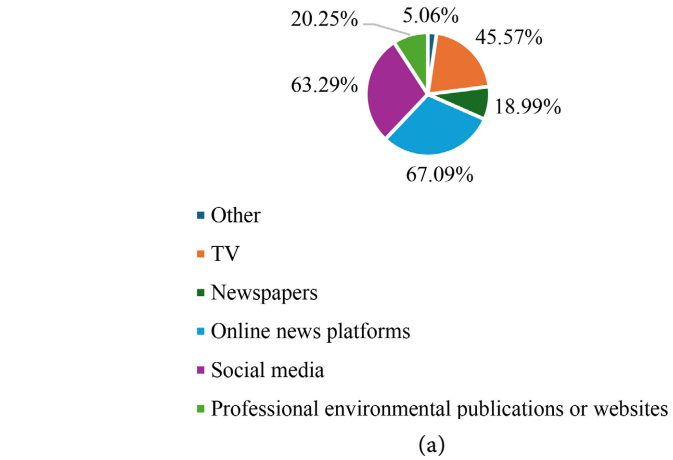


(b)

Figure 2. Frequency of public participation in science communication activities (Left) and platforms for receiving science communication information (Right).



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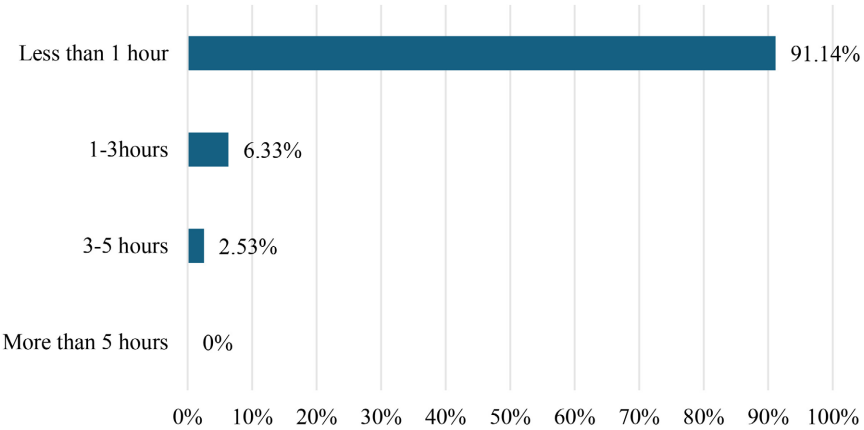

(a)

Figure 3. Channels for receiving science communication information (left) and weekly duration of public attention to environmental information (Right).

A similar situation exists in accessing environmental information—while the public can obtain information through various channels, their attention span remains very short. (**Figure 3**)

2. Half of the respondents expressed dissatisfaction with science communication activities, with interest being the most anticipated aspect.

In response to the question "How satisfied are you with the water resource and environmental science communication activities you have participated in?", only 50% of respondents expressed satisfaction with the activities (Figure 4).

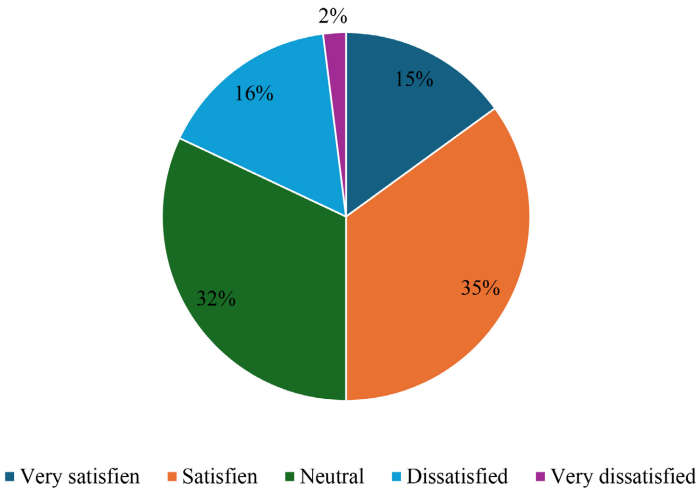

Figure 4. Public satisfaction with water resource-related environmental science communication activities.

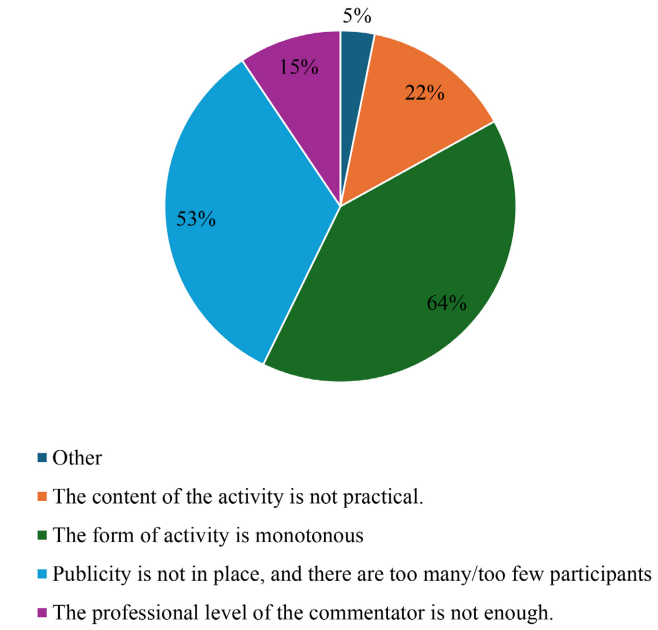

Figure 5. Main reasons for public dissatisfaction with water resource-related environmental science communication activities.

The three main reasons for dissatisfaction were monotonous formats (64%), insufficient promotion (53%), and lack of practicality (22%) (Figure 5).

In the "Other" category, additional reasons included:

● "I want a detailed report that is easy to read, consolidating all the data, solu-

tions, progress, and underlying principles in one place".

- "Mandatory for school courses".
- "Not interesting".

3. The public remains confident in environmental science communication activities and anticipates artistic approaches to science communication.

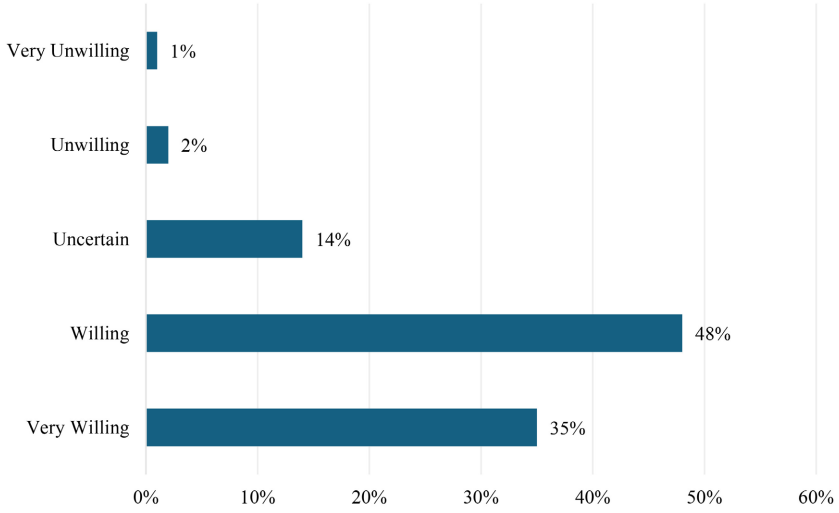

Figure 6. Public willingness to participate in science communication activities in the future.

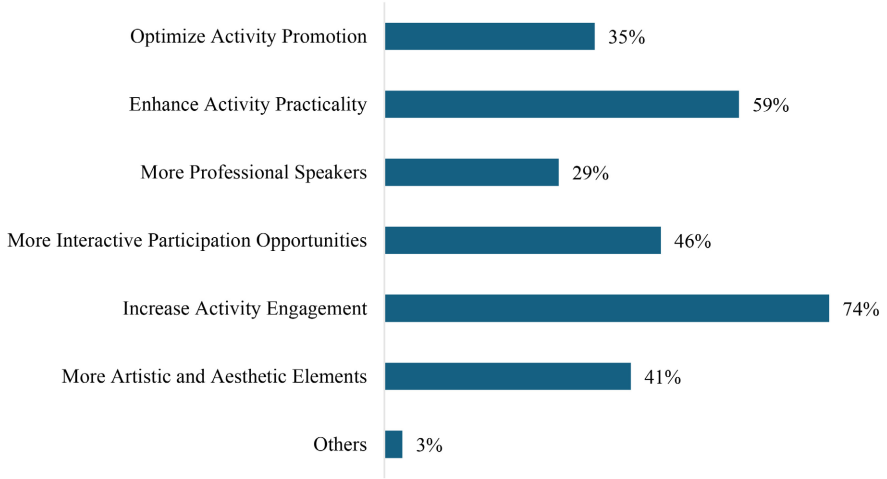

Figure 7. Aspects the public hopes to see improved in environmental science communication activities.

The survey results show that 83% of respondents are still willing to participate in water resource environmental science communication activities in the future, while only 17% expressed unwillingness or uncertainty. This indicates that public enthusiasm for environmental protection remains high and confidence in science communication activities is strong. Meeting the public's demand for environmental activities is both necessary and socially valuable (**Figure 6**).

Among the aspects the public hopes to see improved in science communication

activities, engagement, practicality, and interactivity are the top three most anticipated enhancements (Figure 7).

The survey revealed that the public is most interested in participating in environmental activities such as field visits for water resource protection, experiencing interactive science communication with artistic appeal, and joining volunteer protection initiatives(Figure 8).

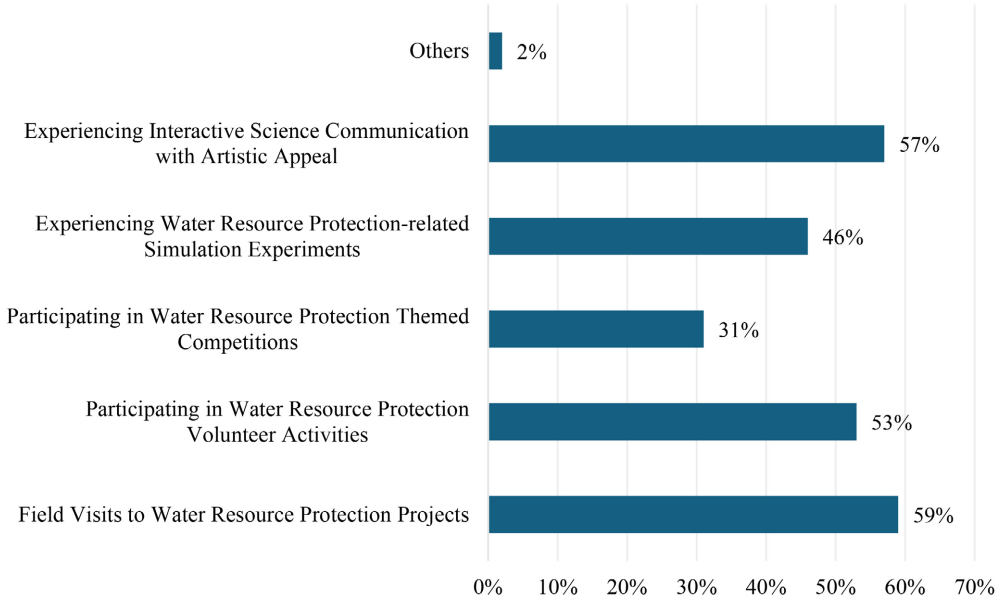

Figure 8. Types of environmental activities the public hopes to participate in.

2.4. Supplementary Research Methods

2.4.1. Sampling Procedure and Sample Characteristics

This study adopted a stratified convenience sampling method, distributing online questionnaires (via Wenjuanxing, a Chinese online survey platform) to the national public, covering three groups: adolescents (12 - 18 years old), college students (19 - 25 years old), and adults (26+ years old). Questionnaires were disseminated through social media, campus groups, and partnerships with environmental NGOs to balance sample diversity.

Sample Screening: A total of 170 questionnaires were collected, with 70 invalid responses excluded (participants who had never engaged in water-related science popularization activities), resulting in 100 valid responses.

2.4.2. Questionnaire Design and Reliability/Validity

The questionnaire was designed based on literature reviews and expert consultations, including the following modules:

1. Demographics: Age, occupation, region (5 questions);

2. Participation Status: Activity frequency, information channels, satisfaction (Likert 5-point scale);

3. Improvement Needs: Multiple-choice and open-ended questions (*e.g.*, "Aspects requiring improvement");

4. Activity Expectations: Acceptance of artistic interactive formats (single-choice and ranking questions).

Reliability and Validity: Internal consistency of scale questions was assessed using Cronbach's alpha coefficient ($\alpha = 0.82$). Content validity was verified by two environmental education experts, who reviewed and revised ambiguous phrasing.

3. Innovation Design

Based on practical action research, this study plans to organize an art science communication exhibition themed around water resource protection. The event will use waste materials to create exhibits, combining artistic expression with the delivery of scientific knowledge. Visitors will need to interact with the exhibits or collaboratively shape them to unveil the scientific information. For example, the exhibit "Flow of Life" uses discarded plastic bottles and recycled materials to simulate a river, integrating lighting and interactive projections to showcase the global water resource situation. Another exhibit, "Uncovering the Truth About Water," involves covering hidden science flashcards with old clothes. Visitors must remove these clothes to reveal shocking data and images regarding the pollution of rivers and water resources caused by the fast fashion industry (Figure 9).

Figure 9. Creation of the "Uncovering the Truth About Water" exhibit.

The science communication exhibition will be set up in two formats: offline in-person exhibition and online interactive exhibition. The offline exhibition will be held on campus, while the online exhibition will be hosted on Tencent Meeting.

4. Verification Results

In the later stage of the event, feedback and suggestions from participants were collected through a questionnaire, and further insights were gathered through in-

terviews with frontline science communicators, enriching the empirical foundation of this study. The post-event questionnaire data showed that the activity not only significantly enhanced participants' awareness of water resource protection but also increased their recognition of artistic science communication formats(Figure 10).

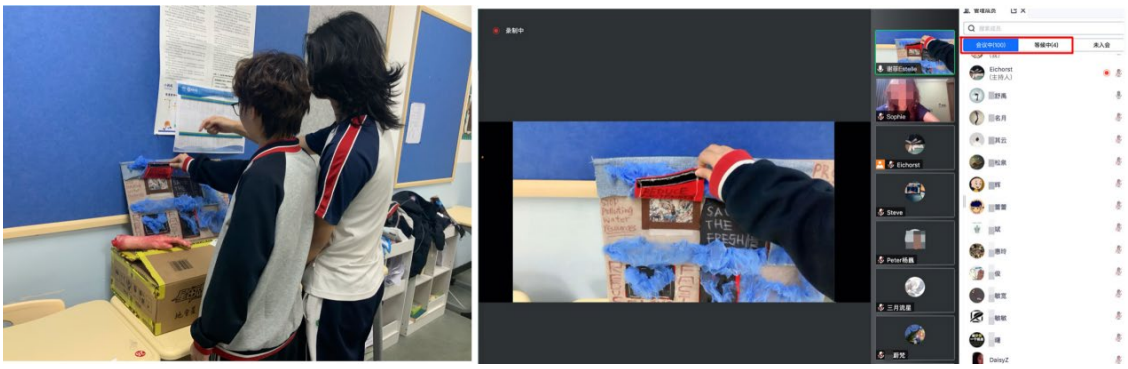

Figure 10. On-site interaction (left) and live exhibition viewing (right).

The event attracted approximately 150 participants, with around 50 attending in person and a peak of 104 viewers for the live stream. All on-site attendees were adolescents. After the event, feedback was collected via QR code scanning at the venue and through online group distribution of QR codes. A total of 75 valid feedback responses were collected. Among these, 48 participants were very satisfied or satisfied with the exhibition, 23 were fairly satisfied, resulting in a satisfaction rate of 94.67% (Figure 11).

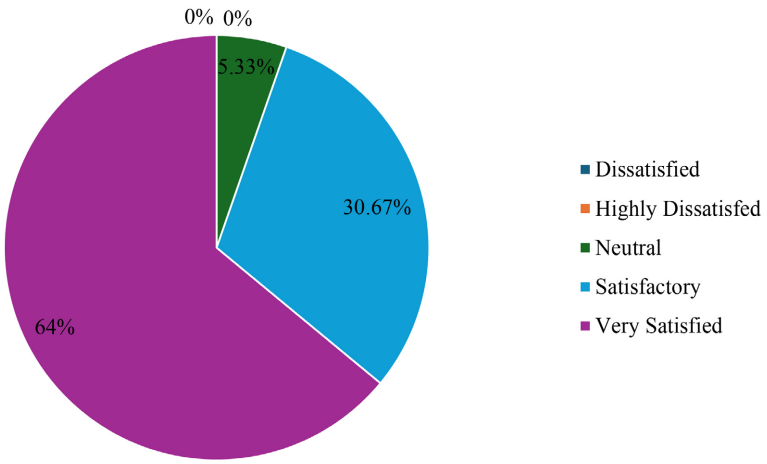

Figure 11. Audience satisfaction feedback results from the exhibition.

The top three aspects that received the highest satisfaction from the audience were strong artistic visual effects, strong sense of participation, and innovative format, with selection rates of 82.67%, 52%, and 50.67%, respectively (Figure 12).

Audience members still had opinions and suggestions for the exhibition, with the most desired improvements being the number of exhibits, the layout of the

venue, and the themes of the exhibits (Figure 13).

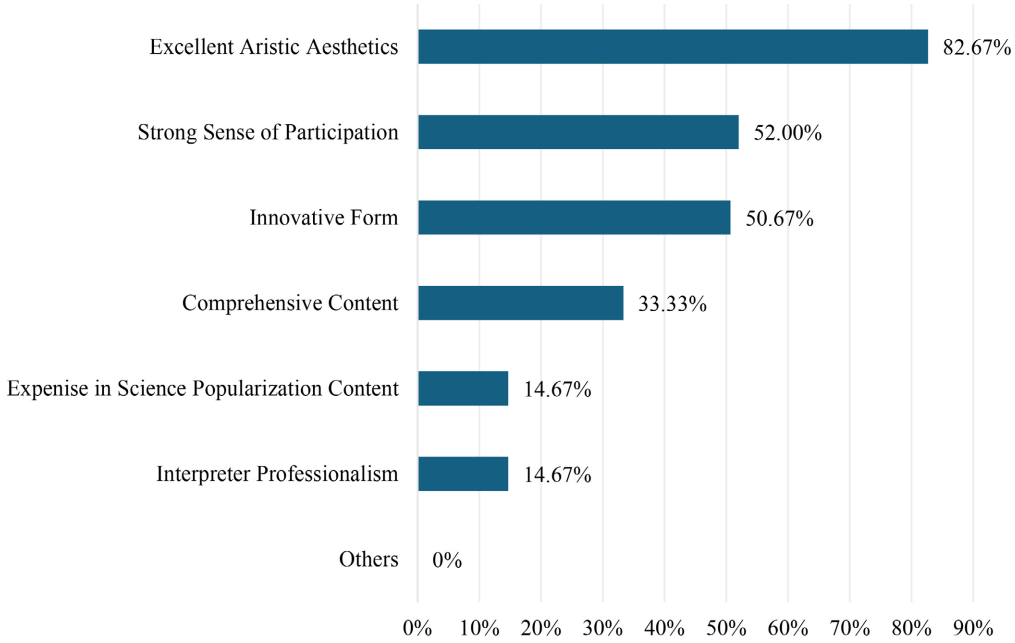

Figure 12. The most popular part of the audience.

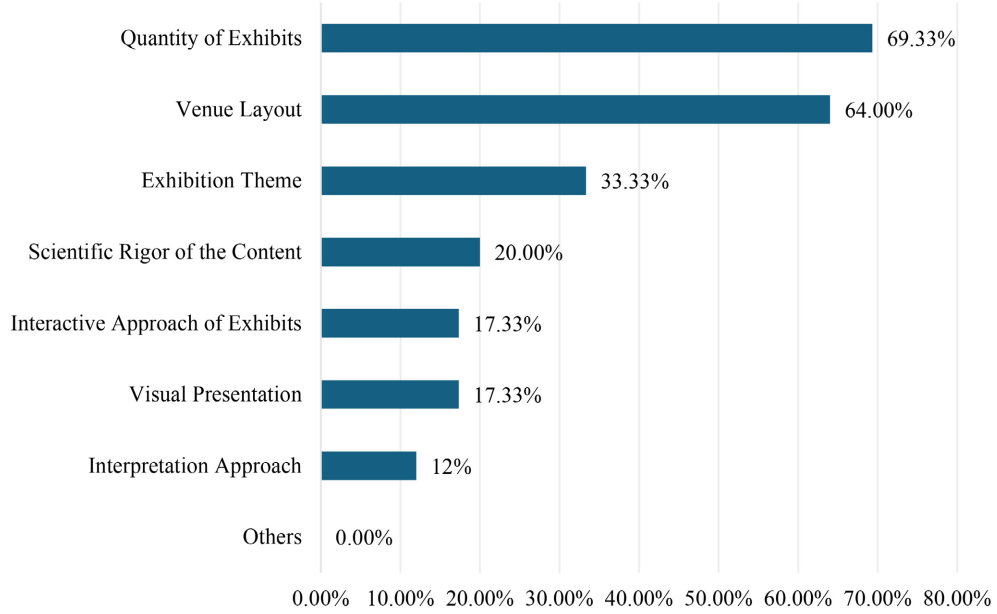

Figure 13. The part that the audience wants to improve most.

At the same time, the research conducted in-depth exchanges with many front-line science popularization personnel who participated in the planning and implementation of activities through interviews, and the research further confirmed the promotion potential of art elements in popular science activities. They generally believe that the combination of art and popular science can effectively improve the communication and social influence of activities, especially in attracting

young audiences. These views provide important support for the theoretical framework of this study.

5. Discussion

In the research on the theme of water resources protection, the preliminary research focused on the current situation of science popularization activities and the shortcomings of its form and content. Through literature research and interviews with science popularization experts, it is found that China has made great progress in environmental protection work under the guidance of the concept of green ecological development, but the problems such as pollution of microplastic particles in the Yangtze River water and water pollution in the textile industry are still serious, so it is of great significance to stronger environmental science popularization work. In the public survey, it was found that there are indeed a variety of popular science activities in various social institutions and departments, and there are many channels for the public to access information on popular science activities. However, the frequency of public participation is extremely low, the sustainability of participation is poor, and it depends on administrative promotion. Many popular science activities have obvious formalization, lack of interest, interactivity and artistry, and are difficult to attract the in-depth participation of different audiences. However, the public is still enthusiastic about environmental protection and environmental science popularization activities, and looks forward to innovative environmental science popularization exhibitions and activities.

The survey further shows that artistic elements and interactive elements are elements worth integrating into the environmental science popularization exhibition, which not only meets the public's expectations, but also enhances the communication effect and educational function of science popularization activities. This is especially important among teenagers because they are at a critical stage of cultivating scientific literacy and environmental protection awareness. The feasibility and potential impact of the form of artistic popularization have been preliminarily verified through documentary method. Therefore, the innovative practice of this research uses waste clothes, waste plastics and other materials to hold an environmental protection exhibition on the theme of water resources in an artistic design way, attracting about 50 live viewers and more than 100 Internet live viewers. 75 feedback questionnaires of the exhibition satisfaction survey were recycled, with a satisfaction rate of 94.67%, and the part that the audience is more satisfied with is the artistic visual and exhibit interactive section, which is in line with the expectation of innovation action.

Limited by venue and personnel, innovative practice cannot be perfect in terms of exhibition scale, venue refinement and number of exhibits. Through the questionnaire feedback, more design and attempts will be made on the art form, interaction mode and theme selection of the exhibits in the future, and the latest data and more popular science content will be added to the popular science content that guides real life.

6. Limitations

Sample Representativeness: Online sampling may overrepresent environmentally conscious groups, with a higher proportion of adolescents, limiting generalizability to the broader population;

Self-Selection Bias: Internet-based surveys rely on voluntary participation, potentially underestimating opinions from groups indifferent to environmental activities;

Scale Constraints: Limited exhibition space and funding restricted the number of exhibits and interactive formats, affecting the universality of conclusions;

Short-Term Evaluation: Immediate post-event feedback measured satisfaction but lacked long-term tracking to verify sustained improvements in environmental awareness;

Methodological Limitations: Cross-sectional design cannot establish causality, and self-reported data may be influenced by social desirability bias.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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