



Research on Winter Sports Promotion Based on the Dissemination System of Chinese Science and Technology Museum

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Abstract. During the Beijing Winter Olympics, winter sports were widely promoted and popularised in China. Snow and ice science education is an innovative fusion of science education and winter sports based on the science dissemination system of the China Science and Technology Museum, which promotes and popularises winter sports while revealing the scientific knowledge behind winter sports, thus raising the public' awareness of winter sports and stimulating their interest and participation in winter sports. This paper to conduct a questionnaire survey on 1729 audiences who attended the ice and snow science education at the China Science and Technology Museum to understand the actual situation of their participation in winter sports and ice and snow science education, in the hope of providing the development of ice and snow science education to promote the high-quality development of winter sports in China.

Keywords: winter sports · science popularization · popular sports · Ice and Snow Science Education

1 Introduction

The 2022 Beijing Olympic Winter Games has inspired hundreds of millions of people in China to participate in the winter sport, and the reality of the vision of “300 million people participating in winter sports” has driven the development of winter sports in China by leaps and bounds, as well as bringing new development opportunities for winter sports worldwide. After the Winter Olympics, how to maintain the enthusiasm of the public for winter sports while achieving quality development of winter sports has become the primary issue for the development of winter sports in the post-Winter Olympics period? General Secretary Xi Jinping also said at the Beijing Winter Olympic and Paralympic Games Concluding Ceremony: “The Beijing Winter Olympic and Paralympic Games have both a physical legacy in terms of venues and facilities, as well as a cultural and talent

legacy, which are valuable assets that should be fully utilised to become a new driving force for development and to maximise the benefits of utilising the Winter Olympic legacy”.

Science Popularization of Ice and Snow is an innovative approach to the promotion and popularisation of winter sports during the Beijing Winter Olympics, focusing on the innovative development of the promotion and popularisation of winter sports by integrating science and sports, aiming to help the public understand the scientific knowledge contained in winter sports, and to promote the popularisation of winter sports and the dissemination of health knowledge, not only to stimulate the enthusiasm of the public to participate in winter sports but also to promote the cultural environment of sports and fitness. The combination of science education and winter sports is the future strategy for the popularization and sustainable development of winter sports, and is also the inevitable way to enhance the educational connotation and educational value of China's science popularization.

2 Definition of Key Concepts

A) Science Popularization

“Science popularisation” is an abbreviated term for the popularisation of science and technology. Science popularisation in China emerged with the introduction of Western science and technology into China, and with the increasing importance of science and technology to social development, science popularisation in China has entered a new stage of development [8]. After the founding of the People's Republic of China, the Chinese government has determined the status of popular science in China's policy by means of legislation. Therefore, popular science in China also has the characteristics of government-led, top-down, and elite implementation [9].

Science popularisation is to educate specific groups of people and to popularise scientific and technological knowledge, advocate scientific methods, disseminate scientific ideas, promote the scientific spirit and establish scientific ethics in a popular and participatory way, so as to improve the scientific and cultural quality and moral quality of the whole nation [5]. Scientific and technical knowledge is the main content of Science popularisation. Traditional Science popularisation is based on visits, lectures and plays, and it is carried out through large-scale science activities such as holding science competitions and science and technology exhibitions. With the continuous development of science and technology and the improvement of the public's scientific literacy, the content of science popularisation has also changed from the popularisation of basic knowledge of natural science to a combination of the promotion of practical technology and the propagation of scientific and technological knowledge, and the form of communication has also paid more attention to equality and two-way interaction. The rapid development of the Internet also makes the construction of online science platform and the development of online resources also become an important development direction of China's science popularization work. Modern information technologies such as network technology, multimedia technology, and virtual reality technology are used to develop physical science popularization resources, integration and digital transformation of the construction of

digital science and technology museum, the use of digital technology and science resources for effective combination, breaking through the constraints of time and space, convenient and fast for the general public to provide public welfare ice and snow science popularization resources [1].

B) Ice and Snow Science Education

Ice and snow science education is a popular science education work with the theme of “Winter Olympics” and “Ice and Snow Sports” carried out by the China Science and Technology Museum (CSTM) relying on the modern science and technology museum system during the Beijing Winter Olympics. Under the protection of the dissemination system of the CSTM, innovative Olympic education and snow sports culture promotion methods, ice and snow science education as a new field in science education, using a combination of online and offline ways to carry out ice and snow science education activities [2]. It is an innovative combination of science popularization and the promotion and popularization of winter sports by presenting the history of winter sports, explaining the scientific principles of winter sports, demonstrating scientific and technological innovation to help Beijing host the Olympic Games, and looking forward to the sustainable development of cities after the Winter Olympics [3].

Sports have the natural attributes of physical participation, which is very different from the popularization and promotion of natural science. The innovative integration of winter sports and science population should not only conform to the characteristics of winter sports, but also meet the needs of popular science education to improve the scientific literacy of the public. Through a fun and lively way to achieve good interaction with the audience, the ice and snow science education transforms obscure scientific knowledge and mysterious sports phenomena into a form that is pleasing to young people, igniting the flame of ice and snow dreams in their hearts and enhancing their understanding of the scientific knowledge behind winter sports, achieving the purpose of both pleasure and knowledge growth. With its intelligent, convenient, professional and situational features, ice and snow science education has been popularised and promoted throughout the country, realising the linkage between sports and science and technology, and driving the positive improvement of scientific literacy among the general public, especially young people.

3 Ice and Snow Science Education Methods and Content

Ice and snow science education is built with the help of the dissemination system and rich science resources of the CSTM, which has established an ice and snow science education model at different levels of national, local and grassroots communities. Build ice and snow science education into a “four-in-one” promotion and popularization system of physical, mobile, digital, and virtual, and use a combination of online and offline methods to promote and popularize winter sports, forming a linkage mechanism and cooperating with each other to realize the nationwide promotion and popularization of ice and snow science education.

3.1 “Four in One” Ice and Snow Science Education

The “four-in-one” science promotion system is a dissemination system for the popularization of science and technology in CSTM, which consists of physical science museums, mobile science museums, science caravans and digital science museums [7].

The physical science museums mainly aim to stimulate the audience’s scientific interest and enlighten scientific concepts through permanent and short-term exhibitions. Through a variety of ice and snow science exhibits and Winter Olympics education activities, it realizes the innovative combination of science education and ice and snow sports, promotes winter sports in science popularization, and popularizes scientific knowledge in winter experience.

The mobile science museum provides mobile, interactive ice and snow science exhibitions and Winter Olympics education activities for the public in areas where science and technology museums have not yet been built. As an effective complement to physical science museums, it has helped to promote and popularise winter sports in the region.

The science caravan is a specially modified vehicle equipped with on-board exhibits and other science resources, designed to provide science services to schools, communities and rural areas at the grassroots level.

The Digital Science Museum, as an online science platform, uses modern information technology such as network technology, multimedia technology and virtual reality technology to develop and digitally transform science resources. It realizes the effective combination of digital technology and ice and snow science resources, breaks through the limitations of time and space, and provides public welfare ice and snow science resources for the public conveniently and quickly.

3.2 The Content of Ice and Snow Science Education

Ice and snow science is mainly through themed exhibitions to educate the public, especially young people, on public welfare science, to stimulate the public’s enthusiasm for winter sports, and to enhance their knowledge of winter sports. The “Winter Dreams Fly - Science and Technology for Winter Olympics” national physical exhibition at the CSTM during the Winter Olympics will popularize the knowledge of science and technology for Winter Olympics and winter sports to the public, promote the Olympic spirit and snow sports culture by presenting the history and development of winter sports and the Winter Olympics, interpreting the scientific principles in winter sports, demonstrating science and technology innovation to help Beijing host the Olympics, and looking forward to the sustainable development of cities after the Winter Olympics. Mobile science museum and science caravan are mobile, flexible and active to provide ice and snow exhibits and education activities for areas that have not yet built physical science museums, helping the public in remote areas to understand cutting-edge scientific knowledge and feel the passion of winter sports, which are especially popular among the youth groups.

4 Research Objectives and Methods

4.1 Research Objectives

Take The actual situation of CSTM audiences participating in ice and snow science education as the research object, this paper studies and analyses the of the Winter sports

participation of the audience participating in the ice and snow science education, the reasons that affect the participation of the Winter sports, and the influence of the ice and snow science education on the participation of the Winter sports are carried out.

4.2 Research Subjects

In February - May 2022, a questionnaire survey was conducted among visitors of CSTM. A total of 1,800 audiences were randomly selected from the visitors of the “Winter Dreams Fly - Winter Olympics in Science and Technology” exhibition at the CSTM for the questionnaire survey, 71 invalid questionnaires were verified and 1,729 valid questionnaires were returned, with an efficiency rate of 96%. The questionnaires were collected by CSTM staff who underwent a uniform questionnaire training to ensure the smooth implementation of the survey. The purpose of the questionnaire was communicated to the audience prior to answering and informed consent was obtained prior to the questionnaire being administered.

4.3 Statistical Methods

The results of the questionnaire were analysed using SPSS analysis software to identify significant results for the target questions in the questionnaire.

5 Participation in Winter Sports

5.1 Winter Sports Participation Rate and Project Analysis

China’s existing development and construction of winter sports relies heavily on the state’s layout and planning for the development of sports, which has led to the formation of an ice and snow sports development mindset and development pattern oriented towards competitive achievements in winter sports [6]. The holding of the 2022 Beijing Winter Olympics has brought a huge opportunity for the development of winter sports in China, and greatly enhanced the enthusiasm of the public to participate in winter sports. According to the results of the questionnaire received, 89.82% of the audiences to this themed exhibition had participated in winter sports themselves, while only 10.18% had never participated in winter sports before. The number of spectators participating in winter sports in order of preference was: skating (70.21%), skiing (62.52%), curling (26.26%), ice hockey (21.98%) and other (0.17%). Although the winter sports development strategy, which is oriented towards competitive performance, has contributed to the rapid development of winter sports in China in a short period of time, it has also led to a relative lag in the development of popular winter sports, which is not conducive to long-term healthy development (Table 1).

5.2 Reasons and Analysis of Influencing Participation in Winter Sports

According to the survey, the factors affecting audience participation in winter sports mainly come from three aspects: high technical and price thresholds for winter sports,

Table 1. Winter sports participation

Term	Total	Number	Percentage
Skating	1729	1214	70.21%
Skiing	1729	1081	62.52%
Curling	1729	454	26.26%
Ice Hockey	1729	380	21.98%
Other	1729	3	0.17%
None	1729	176	10.18%

insufficient publicity of winter sports knowledge, and weak cultural atmosphere of ice and snow.

First, the technical and price thresholds for winter sports are relatively high. The public believes that the high exercise risk of winter sports (44.01%) and the lack of professional venues (27.53%) are the main factors hindering people from participating in ice and snow. Winter sports require a high level of skill and a certain level of balance, flexibility and coordination. The lack of technical mastery leads to safety problems in winter sports, which discourages many people from choosing snow sports and reduces the interest of the general public in participating in winter sports. At the same time, due to the nature of winter sports, there are high requirements for the cost of the sport, renting ski equipment is expensive (15.73%), the high price of tickets (13.82%) and the inconvenient access to ice and snow venues (18.33%) have resulted in a high price threshold for ice and snow sports, which affects the sustainable development of ice and snow sports.

Second, the publicity of winter sports knowledge is insufficient. The lack of knowledge about winter sports (32.91%) leads to a low participation rate in winter sports, even if the public is enthusiastic about participating in winter sports. The promotion and dissemination of knowledge about ice and snow sports is also mainly focused on youth groups, and the promotion and dissemination of knowledge about winter sports to the general public is weak. The lack of a professional platform for the promotion and dissemination of snow and ice knowledge also leads to a lack of understanding and low awareness of winter sports, which affects the public's personal participation in winter sports.

Thirdly, there is a weak cultural atmosphere of ice and snow. The low level of recognition of winter sports among the general public, the lack of a stable snow and ice club (19.66%) and the lack of people around who have participated in winter sports (18.05%) make going skiing and skating a "solitary" game for one's self. The support and approval of family members (13.36%) also affects participation in winter sports, indicating that the society has not yet formed a strong ice and snow cultural atmosphere (Table 2).

Table 2. Factors influencing participation in winter sports

Term	Total	Number	Percentage
Exercise risk of winter sports	1729	761	44.01%
Lack of professional venues	1729	476	27.53%
Renting ski equipment is expensive	1729	272	15.73%
High price of tickets	1729	239	13.82%
Inconvenient transportation	1729	317	18.33%
Lack of knowledge about snow and ice sports	1729	569	32.91%
Lack of people around who have participated in winter sports	1729	312	18.05%
Lack of a stable snow and ice club	1729	340	19.66%
Family support	1729	231	13.36%
other	1729	10	0.58%

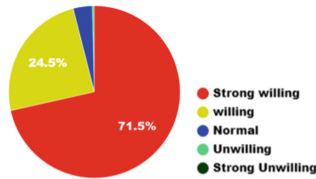


Fig. 1. Interest in learning about snow and ice after snow and ice science education

6 The Influence of Science Popularization on Participation in Winter Sports

6.1 Experiential Exhibits to Stimulate the Public’s Interest in Winter Sports

Science popularization as a form of informal education, good interaction with exhibits while learning and understanding science is essential to stimulate the imagination, creativity, interest in exploration and thoughtfulness of the audience [4]. The survey showed that 71.5% of the audience were strong willing to learn about knowledge of winter sports after the ice and snow science education, indicating that the audience was inspired by the ice and snow science education, which is conducive to further building the audience’s correct understanding of winter sports and cultivating sports habits. The survey showed that 70.4% of the audience were strong willing to watch ice and snow competitions after receiving ice and snow science education. It shows that the audience has achieved good interaction with the exhibits in the ice and snow science education, enhanced their enthusiasm for winter sports in the experience and interaction, and promoted the promotion and popularization of winter sports (Figs. 1 and 2).

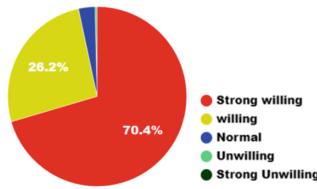


Fig. 2. Willingness to watch ice competitions after snow and ice science education

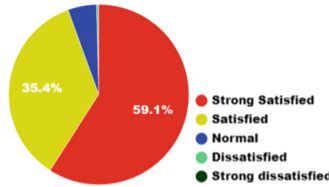


Fig. 3. Can it meet your demand for knowledge of ice and snow sports

6.2 Enhancing the Basic Theoretical Knowledge of Participants in Winter Sports

Winter sports are special and require a higher level of skill, and the technical threshold is a major problem that limits the spread of winter sports. The theoretical level of winter sports affects the public’s understanding of winter sports and the proficiency of motor skills. Ice and Snow Science Education actively explores methods and forms of spreading knowledge of winter sports from a science perspective, providing a large number of innovative exhibits for the science education process while also ensuring the scientific, educational, interesting, safe and participatory content of ice and snow science education for the audience, laying the foundation for popularising and promoting knowledge of ice and snow sports. The survey results show that 59.1% of the audience think that the ice and snow science education very much meets their needs for knowledge about the Winter Olympics and winter sports, indicating that the content of ice and snow science education better met the audience’s needs for knowledge about ice and snow sports and to stimulate the public’s interest in winter sports, especially the youth (Fig. 3).

The ice and snow science education has also greatly enhanced the audience’s understanding of ice and snow sports. Before participating in the ice and snow science education, the audience’s understanding of ice and snow sports was low, 42.51% of the audience said “I know it quite well”, and 30.71% of the audience said that “it’s hard to explain”, after receiving ice and snow science education, the audience’s understanding of ice and snow sports related knowledge has been greatly improved, and 63.85% of the audience said “I know it”. It proves that ice and snow science education can popularize winter sports knowledge and improve the public’s awareness of winter sports, thereby further reducing the difficulty for the public to master action techniques, and reducing the entry technical threshold for beginners to achieve the popularization of winter sports (Fig. 4).

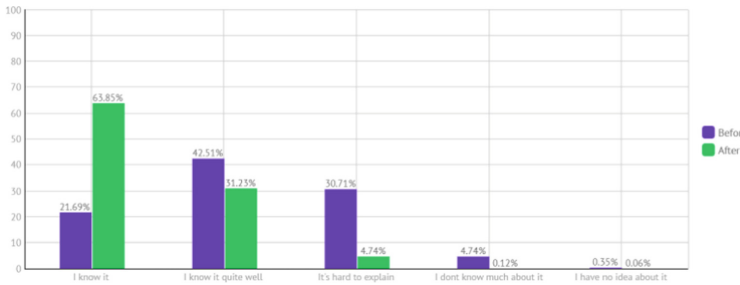


Fig. 4. The public’s understanding of winter sports knowledge before and after participating in ice and snow science education (N = 1729)

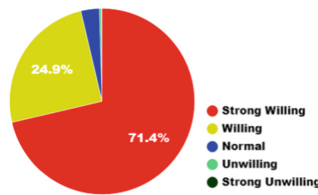


Fig. 5. Willingness to share knowledge with family or friends after ice and snow science education

6.3 Integration of Winter Sports and Science Popularisation to Create a Culture of Snow and Ice

Ice and Snow Science Education leverages the sound dissemination system and mature science resources of CSTM to create a unique ice and snow cultural atmosphere by integrating snow and ice culture with ice and snow science education in the process of promoting and popularising winter sports. In the process of receiving ice and snow science education, young people not only learn about winter sports and the scientific knowledge behind them, but also the unique interactive experience of science makes young people broaden their horizons, enjoy their bodies and minds, and feel the special charm of winter sports in the interaction with the exhibits, and ice and snow culture is quietly formed in this special environment, sowing the seeds of winter sports in the hearts of young people.

At the same time, most of the participants in the ice and snow science education were family members, and the participation of family members also made it possible to attract more people to learn about winter sports. The survey found that 71.37% of the audience who participated in ice and snow science were “very willing” to share some winter sports knowledge gained from participating in the exhibition with their families and peers. Ice and snow science education not only improved the public’s awareness of winter sports, but also through joint participation Promoting harmonious relationship between family members is conducive to the formation of a good ice and snow cultural atmosphere in the society (Fig. 5).

7 Conclusion

China's winter sports have developed rapidly during the Beijing Winter Olympics. The single ice and snow sports event, the high technical and price thresholds, the lack of public awareness of ice and snow sports, and the lack of an ice and snow cultural atmosphere hinder the sustainable development of ice and snow sports. The ice and snow science education based on CSTM has realized the innovative integration of science popularization and winter sports, made the public understand winter sports from a scientific perspective, further exerted the social function of sports, and effectively improved the public's scientific knowledge reserve while promoting and popularizing winter sports. Realize the linkage development between sports and science and technology. Ice and snow science education has also become one of the effective means to promote the overall improvement of young people's scientific literacy and comprehensive quality, and will make a positive contribution to the high-quality development of winter sports and the improvement of national scientific literacy in China.

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