The Potential of Local Science Festivals for a Sustainable Society

——A case study of the hakodate international science festival

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Abstract: In this paper, I describe a local science festival that I began designing in 2008 and which has been held each year since 2009. I use this case to consider the significance of local science festivals as learning environments for citizens. It is worth mentioning that the design of the local science festival discussed here involved the application of learning theory and philosophy. Rather than 'knowledge transfer' or 'knowledge acquisition', science communication is contingent on inter-personal activity performed through conversations that are inseparable from the situations in which they occur. Science communication is a part of learning activities and should be defined as a process of interaction that transcends a single individual, emerging in the context of social relationships within a broadly inclusive community. Moreover, conviviality, the vernacular, and the commons will also be important when considering the significance of local science festivals. Many cities in Japan and around the world face situations like the one discussed here. It will be meaningful to share the lessons learned and design model used in this case as a 'cultural apparatus'. I believe that local science festivals will contribute to creating a sustainable and resilient society.

Keywords: Science Festival; Science Communication; Science Literacy; Learning; Local Context; Conviviality; Vernacular; Commons; Cultural Apparatus

1. Background

It has been 10 years since the inaugural science festival was held in the Japanese city of Hakodate. The festival is held annually at multiple venues in the Hakodate area for nine days every August. It offers a wide variety of science-related events for everyone from children to adults—for laypersons and experts alike. As a series of preliminary events, hands-on classes and experimental workshops for children are offered through the summer holidays beginning in mid-July. There are also events for adults in September.

The number of people involved in carrying out the operational tasks for the festival has been increasing each year; thus, it has gradually become an established event. People from diverse backgrounds bring their interests and ideas, forming multiple groups loosely joined with one another. Though funding has been a challenge each year, we have steadily gained the support of local businesses and leveraged the festival's strengths as a networked organization. Contributions of free drinks, product samples, and a free venue are appreciated. The festival is a place for participatory and collaborative practices generated by the mutual exercise of the knowledge, skills, and ideas brought by various individuals.

I was involved in establishing and drawing up the plans for the National Museum of Emerging Science and Innovation (Miraikan) in Tokyo, where I served as the deputy director from 2003 to 2006. At that time, the importance of science communication was beginning to gain recognition as a worldwide trend. After the completion of my term of office, when I returned from Tokyo to Hakodate, a regional city with a population of 260,000 people, it came to my attention that Hakodate did not have a science museum or science center. However, I knew that it would be difficult for such a small city to secure a budget for creating and operating a science museum/center.

Therefore, in 2008, I recruited some colleagues to establish Science Support Hakodate as an organization to promote science communication and develop citizens' science literacy. Since 2009,

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we have held the Hakodate International Science Festival every summer. Through trial and error, we have built up our know-how and a record of achievement, resulting in the expansion of our circle of volunteers from industries, academia, and the government, such that our yearly calendar of activities is now more or less fixed.

2. Theory and Philosophy for Designing a Science Festival

To plan a science festival to be held in a local city, two perspectives were considered. One was a learning theory perspective regarding a festival as a place of learning and the other was a philosophical perspective regarding local communities.

1) Learning Theory Perspectives

The need to develop science literacy and promote science communication as a means of doing so has been discussed actively in recent years in science and technology policies and in the fields of science, technology, and social studies. However, these discussions have not yet—at least in the context of education and learning—touched on science festivals as a means of realizing this end (Mima and Watanabe, 2008).

A paradigm shift in learning psychology occurred with the transition that began in the 1980s from behaviorism to social constructivism to a situated model. Learning came to be reinterpreted from 'something passive' to 'something active' and from an 'individual enterprise' to a 'social enterprise' (Mima and Yamauchi, 2005). In other words, learners came to be seen as having the power to engage their own environment and seize knowledge, and learning came to be seen as a process of collaborative activity and discussion with others. It has been a shift from individual to collective learning focused on the importance of society, culture, and others. Moreover, this way of thinking has also demanded a shift in the nature of worldly things and knowledge. From something static and fixed, knowledge has come to be recognized as being socially constructed—something built communally in the context of communicative processes.

2) Philosophical Perspectives

When thinking about a science festival deeply rooted in a local community, it is useful to think about the concepts of conviviality, the vernacular, and the commons, as discussed by Ivan Illich, a philosopher who was active in the latter half of the 20th century. These important concepts are featured in Illich's most eminent works, *Deschooling Society* (Illich, 1971), *Tools for Conviviality* (Illich, 1973), and *Shadow Work* (Illich, 1981). These concepts have been reviewed again in the context of the digital society in recent years (Bollier, 2013).

To be 'convivial' means to live together happily in a state of mutual independence. Illich once lived in a village on the outskirts of Cuernavaca, Mexico, and is said to have taken this term from the Spanish word *conviviencial*, used to refer to the ties that linked the indigenous villagers to the commons and the festive interactions that occurred when a market was open (Kurihara, 2006). Local festivals are indeed convivial in this sense, representing an autonomous mechanism that makes life more vibrant and enjoyable.

'Vernacular' refers to the characteristic of being rooted in the realm of everyday life. The term describes something that is neither mass-produced elsewhere nor supplied by the government; rather, it is something of one's own. Vernacular space is something that emerges from the formation of our own space within the mutually beneficial commons in our communities. The vernacular is ultimately neither an acquisitive act realized in the form of an exchange of currency, nor is it an institutionalized service.

The term 'commons' originated from the idea of shared pasturage, and it signifies a communal environment accompanying a convivial life. It is a new social and political sphere in which people can create their own rules and solve problems tailored to local conditions in a grassroots fashion. In contrast to 'resources', commons are something 'shared by everyone', providing a space in which the subsistence activities of people take root.

Through these concepts, Illich argues, things are made rather than consumed; he regards human independence as something that builds up in the form of regional and autochthonous lifestyles in the company of others. Illich also points out the danger of relying on the products and care provided by groups of experts. He maintains that human happiness depends on our subjective understanding of the world; it is consistent with the recent significance of promoting science communication and developing science literacy.

3. Methods

To design and operate a science festival from learning theories and the philosophical viewpoints mentioned in section 2, the work by Mima and Watanabe (2008) was used as a model of community evolution. The following are descriptive of the situation in Hakodate City, where this practice, the model, and activities were implemented.

1) Background of the Initiative

- Hakodate, Hokkaido: the third largest city (260,000 people) in Hokkaido, one of the 47 prefectures of Japan
- Major industries: tourism; fisheries, especially for squid and kelp; and food product manufacturing (processing)
- Annual average income for a Hakodate citizen: $25,000 USD (2017)
- Number of higher education institutes: eight schools and approximately 4,000 students

2) The Evolution Model of a Learning Community

The Hakodate International Science Festival has been designed and operated according to the evolution model of the learning community in Mima and Watanabe (2008). The model has six phases from the phase in which activities are distributed through the phases of networking, organizing, integrating, synchronizing, and emerging as a convivial community (Fig. 1).

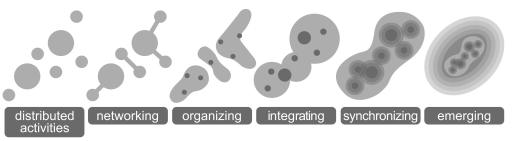

Fig. 1 The evolution model of a learning community. (modified based on Mima and Watanabe, 2008)

3) The Initiative and Its Activities

To operate the science festival, Science Support Hakodate (SSH) was established in 2008 in collaboration with the city administration, higher education institutions, research institutes, and a funding agency (Fig. 2). The mission of SSH is to promote science communication and improve science literacy in the Hakodate area through the Hakodate International Science Festival and other activities.

The tasks of SSH have been managed by 17 members of the steering committee appointed from each participating organization. Future University Hakodate is in charge of the secretariat. The advisory board members from the heads of each participating institute evaluate the annual and medium-term plans. In addition, the voluntary group of citizens—Kagaku Tanoshimitai (Science Enjoyment Corps)—supports activities throughout the year.

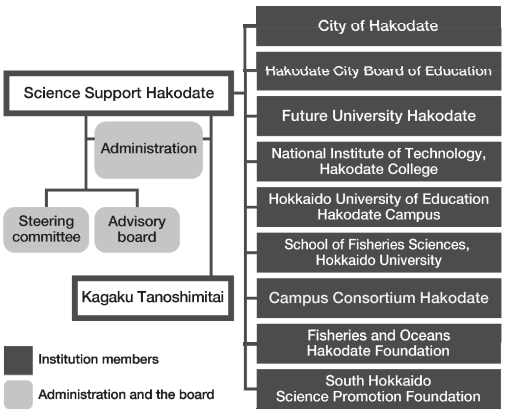

Fig. 2 Organizational chart for Science Support Hakodate.

The steering committee conducts monthly meetings, not only for practical administration but also for the active sharing of ideas. The coordinator makes various adjustments, and each member is in charge of the coordination and internal planning of individual projects within and outside of the affiliated institute. SSH oversees the publicity and design of various products to increase their visibility for citizens.

SSH is also conducting a training course—Hakodate Science Terakoya—as well as the science festival. This intensive course has been designed to develop science communicators and regional coordinators among college students and citizens.

4. Results

The results of our efforts over 10 years are as follows.

1) Hakodate International Science Festival

- Inauguration: August 2009
- Duration: nine days ending on the final Sunday in August
- Organizer: Science Support Hakodate and a steering committee of 17 people
- Annual revenue: includes monies from the social contribution budget of Future University Hakodate, corporate sponsors, etc., totaling $36,000 USD
- Expenditures: event-related expenses, advertising expenses, gratuities, etc.

Trends in numbers of participants and partners and a breakdown of exhibits and joint displays at the 2017 Hakodate International Science Festival are shown in Fig. 3 and Table 1.

There are several ways to contribute to the festival. The method and process are shown in Table 2 and Fig. 4.

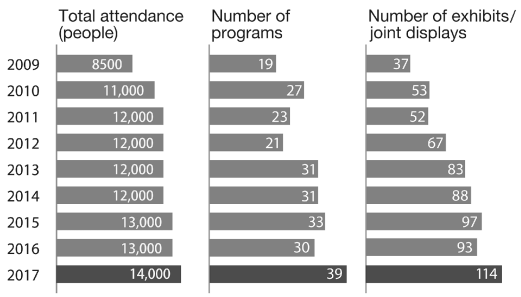

Fig. 3 Trends in numbers of participants and partners.

Table 1 Breakdown of exhibits and joint displays at the Hakodate International Science Festival 2017.

Category	Number of Exhibits Joint Displays
Schools	37
Political, economic, and cultural organizations	31
Academic and R&D organizations	11
Other education and learning support industries	9
Local public agencies	5
Professional service industries (not classified elsewhere)	4
Information service industries	2
Food and beverage retailers	2
Other retailers	2
Medical industries	2
Others (general construction industries, etc.)	9
Total	114

Table 2 The ways of contribution.

Ways of Contributing	Overview	Arranging the Venue	Expenses	Responding to Entry
PR partner	Post information of exhibitor's event as part of the science festival program to PR media	Exhibitor	Exhibitor	Exhibitor
Exhibitor's own project	Exhibitor presents original program at the festival; assumes CSR activities	SSH	Exhibitor	SSH/Venue facilities
Regular venue/ conventional style	Format is a science booth, science cafe, stage event, etc.	SSH	Exhibitor with support from SSH	SSH
Invited guest	SSH invites local and national performers	SSH	SSH	SSH
Others	Collaborate with SSH to implement an event	Negotiable	Negotiable	Negotiable

Fig. 4 Process for determining events for the science festival.

2) Training Course (Hakodate Science Terakoya)

Every year, the three-day intensive training course, Science Terakoya, is offered before and after the science festival for college students and citizens. The themes dealt with so far are as follows:

- Development of scientific events
- Information design
- Dissemination of information by media
- Science communication aimed at informing citizens about food safety in the region
- Linking science to everyday life based on an understanding of yourself
- Science demonstration by Dr. Nabe
- Workshop for communicators connecting sea, ship, stars, and science

3) Major Activities

The following are the major activities associated with expansion of the science festival:

(1) *One year prior to the science festival (until 2008; Distributed Activities Phase)*

Before the science festival was held, various science events were held in the city on weekends and holidays throughout the year. Organizers were individuals, groups of volunteer citizens, and organizations such as universities and research

institutes. Their advertising methods were ad hoc and included distributing flyers and announcing events on their websites. As a result, information did not reach the targeted people properly.

(2) *Holding the science festival (from 2009; Networking Phase)*

SSH has been inviting individuals and organizations to conduct science events as exhibitors in the science festival. SSH advises them that festival participants enjoy an intensive week during the summer to reach citizens through science events. SSH provides the venue and publicity at no additional cost.

Emphasis is placed on the design of productions and exhibitor space. SSH engages the services of an art director and produces poster leaflets, program brochures, banners, etc., according to the theme of the festival. While such actions promote visibility to citizens, it also fosters unity among exhibitors.

As previously mentioned, SSH holds an intensive course—Hakodate Science Terakoya—every year to develop science communicators. The course is also open to citizens and college students.

(3) *Birth of citizens' groups (from 2012; Organizing Phase)*

Two civic groups have emerged during this period. One is a performing group and the other is the curating team.

a) Performing group

Upon attending Science Terakoya in 2011, a group of voluntary citizens known as Kagaku Tanoshimitai (Science Enjoyment Corps) was born (Fig. 5). The group is composed of people of varying ages and occupations, including business professionals, homemakers, retirees, municipal officials, teachers, and students. An evening meeting is held once a month as a space for learning, exchanging information, and sharing experiences. At the science festival, in addition to working as voluntary staff, the group also holds its own science shows and workshops. Although the group was formed for the members' mutual enjoyment of science, in recent years, it has started to receive occasional requests to put on science shows and workshops throughout the year.

Fig. 5 Kagaku Tanoshimitai.

Chikako is a female member of the group. She used to be a physics teacher. When she moved to Hakodate, she quit her job because of family circumstances. After learning of the existence of Kagaku Tanoshimitai from the newspaper, she began to take part in its activities. She is now in high demand as a science communicator in the Hakodate area (Fig. 6). She stages science shows and workshops for children and parents in venues that include local kindergartens and nursery schools, elementary schools, and shopping malls. Beginning this year, she has taken the rostrum once again as a part-time instructor at a high school.


Fig. 6 Ms. Chikako's Show.

One of her charms is her approach. Using materials found in one's house, she tells children's mothers that 'you can also do this at home' and 'you can find these materials in any 100-yen shop' (the Japanese equivalent of a dollar store). As a result, ideas well up in their heads, making them want to experiment for themselves when they return home. The important thing is that instead of showing something off in a one-sided manner—like an 'amazing' magic trick— her stance is 'Let's do it together' and 'You can do it, too!' Her incredibly fun and energetic mode of activity has also been attracting new partners. Several other examples exist of regular citizens who became active as science communicators after being inspired at the science festival.

b) Curating team

Every year, the special exhibition in the festival

is conducted by SSH as the organize's message to the public and a challenge to make them aware of modern scientific issues. The exhibition was carried out with borrowings from Tokyo and other big cities for the first three years. Eventually, some people decided to carry out a special exhibition by themselves and organized a curating team. The members include writers, photographers, graphic designers, and researchers. In line with the festival theme for each year, the exhibition appeals visually to festival goers; topics have included the environment, food, and health—issues that have local as well as global ramifications (Fig. 7). To develop the contents of the exhibition, the curating team interviews local people, such as scientists, farmers, people working in the fishery industry, and government workers.

A workshop is held by the team to promote an understanding among citizens of the meaning of the exhibition on the evening preceding the opening. SSH creates a printed catalog of exhibitions, distributes them, and also publishes a digital version on its website. After the science festival, the exhibitions are available for use by schools, institutes, and city halls for free.

Fig. 7 The special exhibition.

(4) *Cycle and guidelines (from 2015; Integrating Phase)*

a) Learning cycle throughout the year

Since the science festival's eighth year, the annual cycle of activities has become more or less fixed (Fig. 8). First, in January, SSH puts out a general call for participants in what we call the 'kick-off.' Workshops are held to generate and discuss ideas about events for the festival. Participants' motivations are varied: some already have their own ideas and are seeking collaborators; some want to flesh out their concepts further; some have interests in themes like the environment, food, and health; and others are interested in education and community activities in general.

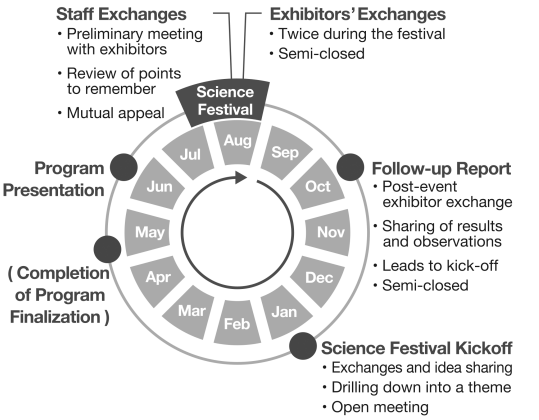

Fig. 8 Annual schedule of the science festival community.

Several groups are assembled to make the ideas generated by the kick-off reality. By June, all programs are fixed and announced to the press. In early August, the exhibitors come together for a social gathering during which we review various points to remember during the festival's run. Each group introduces its respective events and shares expert know-how; topics include methods for increasing attendance.

In the latter days of August, during the run of the science festival, we hold a social gathering for exhibitors and include guests who have traveled considerable distances. A month after the festival is over, we hold an exhibitors' meeting to share our experiences in a follow-up review of the year's science festival; additionally, we begin preparing for the following year.

What is noteworthy here is that participants in the social gathering held in early August end up participating in the science festival events introduced to them there. Participants at this social gathering are initially interested in a specific field of science, as they are the ones in charge of their own events. Through the social gathering, their interests broaden to include other fields and events, and by participating as guests, they operate as an interface, spreading their interests to the general public.

Getting ordinary citizens with little interest in science to take an interest in the subject based on attending a single event is difficult; even when they do take an interest, it is often only temporary. What the social activities described here have

revealed is the effectiveness of expanding from people with a strong interest to people who are less interested. This result has been substantiated by the increase in exhibitors and joint displays, as noted in Fig. 3.

b) Building guidelines of the community

As the activities of the science festival—now in its seventh year—have continued to expand, so have the number and scope of activities we wanted to undertake. Though it is good for activities to expand, dilution of the characteristics of the science festival as a whole is a possible outcome. Therefore, the necessity of activity guidelines came up for discussion among the members of SSH. Looking back over our experiences to date, the activity guidelines listed below are in place. They were introduced to participants at the science festival kick-off event held in January 2015. These activity guidelines are still shared today whenever the opportunity arises (Fig. 9).

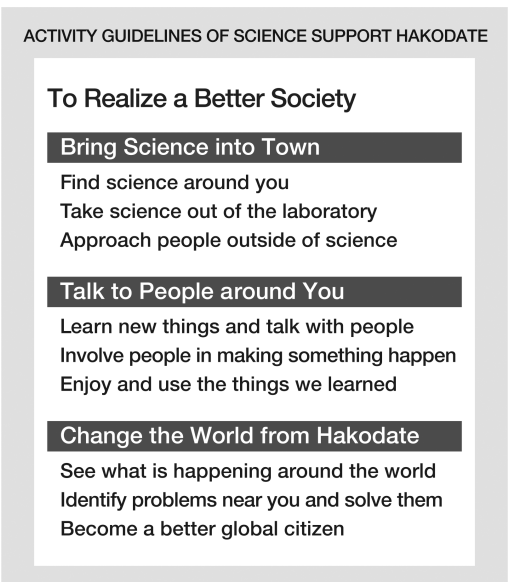

Fig. 9 Activity guidelines for Science Support Hakodate.

(5) *Collaborating with other communities (from 2017; Synchronizing Phase)*

In the ninth year, SSH began to receive offers to carry out events with groups not related to science, such as the Junior Chamber and the Hakodate Women's Conference. SSH has begun collaborating with these groups not only for events related to the science festival, but also for their activities, workshops, and learning groups throughout the year.

There is a symbolic story about connecting different communities. It began with a proposal from a member of Kagaku Tanoshimitai. He wanted to consider the hearing impaired in the science festival. As a result of discussions between Kagaku Tanoshimitai and SSH, it was decided to experimentally use UD Talk (http://udtalk.jp/en/), an application that visualizes communication support and conversations. Now, more than half of all events are using it with technical and financial support from developers in Tokyo. The proposal triggered a connection among tech people in the central city and the disabled community in the local city and SSH (Fig. 10).

Figure 11 shows a scene from the disaster prevention science show in the science festival, which originated with a proposal from the Hakodate Women's Conference.

Fig. 10 Using UD Talk and a sign language interpreter.

Fig. 11 Disaster prevention science show.

5. Discussion

Recently, in school-based education, 'active learning' has been attracting attention as a learning and pedagogical method. It represents a shift away from the conventional method of teaching

with mass lectures. It is a project-based learning style in which students learn actively by discovering challenges independently and working toward solutions. Learning occurs not only in terms of knowledge and skills in related areas, but also with respect to things like teamwork and logical and analytical modes of thought. Even more important is how this experience is conceptualized as knowledge that can be applied in other contexts.

The Hakodate International Science Festival, with reference to the relationship between science, technology, and society, aims to turn people's attention from their immediate problems to the wider world so that they may more easily consider global problems as their own. Beyond the planning and organizing of events, a science festival that includes a cycle of learning, creating, and sharing is such a place of active learning.

Gaining science literacy also leads to the prevention of illness, the reduction of waste, and a lower likelihood of being deceived by unscrupulous business practices. Developing science literacy benefits individuals and reduces social costs in general. Moreover, besides learning about science and technologies related to healthcare, the environment, or food, scientific thinking—in terms of thinking analytically and logically and seeing things critically—is also important. Mastering this kind of knowledge and way of thinking could also affect the next generation, resulting in a positive chain of effects that could lead to the elimination of economic and educational disparities.

From the time it was first held in 2009, the Hakodate International Science Festival has had as its slogan, 'Thinking about the world from Hakodate, and thinking about Hakodate from the world.' By showing the connections between people's immediate problems and those of the world, we help people become conscious of global problems and their potential to solve them, thus putting their thoughts into action. We provide the chance to 'think globally, act locally'.

Regarding the six phases shown in section 3, 2), activities implemented by voluntary citizens' groups have begun. Furthermore, a science communicator emerged, an exhibition curating team was born, a cycle of learning was formed, activity guidelines were created, and contributors to the festival promoted the connection to the community (which is typically unfamiliar with science). These facts show the possibility of promoting science communication and improving science literacy in a way that is different from science museum activities and the local science festival.

It is perhaps necessary to point out here that these developments also seem to relate to the history of the city of Hakodate. Soon after Japan emerged from its period of national isolation, its first public park was built in Hakodate in 1879. Private citizens put up their own money and provided labor to bring the project to completion. Rather than waiting on the government to act, taking action on their own and working together to create a park that they would support and use was a more manageable and comfortable option.

Compared to science festivals in major cities that have large budgets and draw large crowds, a science festival carried out in a community as a grassroots activity is something vernacular—a commons—and may thus be said to be bringing the idea of the convivial society to fruition.

Though sporadic at first, as our networks expand, so too does the circle of resonance, with the whole eventually synchronizing and developing into a large-scale community as shown in Fig. 1. Designing not only science festivals, but any new learning environment in the public sphere, is extremely effective for laying the foundations of science communication activities and stimulating the development of citizens' science and social literacy.

A festival is a kind of cultural apparatus. As stated previously, the festival creates a place of learning and a place of connection in the context of a society dedicated to lifelong learning. The festival is not for appreciation, but for participation. The threshold for participation is low and open to everyone from children to adults and from laypersons to experts. A festival engenders social inclusion. The promotion of social inclusion leads to the transformation of social structures and the construction of a society that can withstand disaster; the aim is a society in which everyone can showcase their latent capabilities and make connections with each other.

Moreover, the method of the festival is one that can be implemented for a variety of subjects, and festivals organized around not only science but also music and books are already underway. More than anything, the festival is an enjoyable, exciting, and ceremonial place—indeed, a convivial sphere.

From local to global connections, festivals provide opportunities for us to be conscious of the

world and take actions even as we think about traditions and regional specificity. The local science festival is a cultural apparatus that we change ourselves in terms of both style and substance to suit the respective history, culture, and circumstances of our individual communities.

6. Conclusion

More than 250 years ago, the philosopher and educational thinker Jean-Jacques Rousseau (1758) opined that holding open-air republican festivals in a rich community atmosphere, rather than establishing a luxurious theater, strengthens a community:

Plant a stake crowned with flowers in the middle of a square;
gather the people together there,
and you will have a festival.

Two-hundred and fifty years later, at the opening of the Hakodate International Science Festival, the following declaration in honor of Rousseau was made:

Bring science into a town;
gather the people together to communicate,
and we will have a future.

Local science festivals are designed and implemented in a context in which people with diverse backgrounds come together. As an adult mode of active learning, they create places to enjoy science, engage in dialogue, and learn, thus leading to future community development. Many cities in Japan and around the world face situations like that of Hakodate. I would like to share the lessons and design models that we learned through the implementation of the science festival as a cultural apparatus. I believe that local science festivals will contribute to a sustainable and resilient society in the future. The challenge to integrate festivals with learning and community development will surely continue.

Acknowledgments

Gratitude is expressed to all current and previous Science Support Hakodate staff and its supporters for their creativity and passion. This work was supported by JSPS KAKENHI Grant Number 18H01056.

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Developing New Strategies for Science Museums in Increasing the Public Understanding of Science: Case Study from CSTM

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Abstract: Science museums have unique resources distinct from formal educational institutions, and play a very important role in bringing science and applied technology to children and adults of all backgrounds, to promote their understanding of science. China Science and Technology Museum (CSTM) has been constantly seeking strategies in the creation, conservation and communication of knowledge and identities. This study examines effective pathways and methods to stimulate the interest of visitors and meet public demand for scientific literacy. (1) Bolster audience participation through digital and intelligent service to make the exhibitions content richer and more interesting. (2) Rethink the role of CSTM in K-12 science education, and to improve the quality and influence of museum-school collaboration. (3) Use social media to expand the influence of the exhibition resources in a way that resonates with the young generation. As a leader in the 'Science museum system with Chinese characteristics', CSTM plays a big part in solving the problem of inadequate public scientific education services in rural areas by promoting the sharing of resources with multiple cooperation projects and platforms. Our findings suggest that science museums should make new and greater contribution to promote the development of a learning oriented society.

1. Introduction

The achievement and advances of science and technology (S&T) are deeply changed the life of general public. All technologies involve advantages and disadvantages that have had a broad and profound impact on the society. It will contribute to the sustainable society when the general public is cable of understanding and support the positive role of S&T. However, the rapid development and complexities of science and technology, such as nanotechnology, biomedical engineering, new and renewable energy, and other discoveries could hinder a clear understanding of the public. To form an environment that the public understand of S&T. Education and communication strategies for the public should be developed in order to strengthen S&T education. This article is divided into three main sections. The first section introduces the role of science museums in increasing the public understanding of science. The second section reports the practice of China Science and Technology Museum. The final section provides reference and reflect on the path through the summary.

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2. The Role of Science Museums in Increasing the Public Understanding of Science

1) The Science Museums

Science museums are defined as socially-involved institutions dedicated to science communication and education. According to Bernard Schiele's definition, science museum is a socially-involved institution dedicated to making the general public aware of the latest science discoveries and development of technology application. (Bucchi, 2014) Historically, the development of science museums has undergone four phases. The first phase of development (1683–1929) was dealt with the enrichment of the collections and displaying the history of technology. The second phase of development (1930–1959) kept pace with the times by showing contemporary science and knowledge distribution. The third phase of development (1960–1975) has a significant effect on the