

## **2049 Shanghai Pilot Project**

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### **Abstract**

Since 2003, Shanghai Association for Science and Technology (SAST) has been engaged in undertaking the <<Shanghai Promotion Pilot Project under Project 2049 on Building the Science Literacy of Chinese Adolescents>>. Taking the educational reform in Shanghai as an opportunity, taking expert resources from academic societies and educational resources as support, taking mature foreign models as references, this project is aimed at building a science literacy training mechanism for adolescents, substantially and overwhelmingly upgrading the level and quality of scientific education curriculum and scientific activities of adolescents, constructing teaching outlines, content and methods in accordance with municipal and national conditions, and finally building regulatory assessment system, so as to make all the adolescents to master a high-level science literacy and all the young scientific talents to have a good opportunity for further development. As a pilot project at some key middle schools in some districts, it is widely welcomed by schools, teachers and students, paving a new way for direct, systematic and wide participation by scientific circle to scientific education for adolescents, and it succeeded in promoting the integration

and utilization of scientific and educational resources both in and out of schools.

## **Key Words**

Adolescents, Scientific Education, Scientific Circle, Educational Circle, Integration

## **Foreword**

21<sup>st</sup> century represents the highly developed times of human scientific civilization as well as the ever-increasing international competition. The core of the competition is on the talented people. For this reason, the Chinese government put forward its strategy that fully builds a wealthy society and enables China to reach the level of moderately developed country in the middle period of this century. This strategy especially emphasizes on “remarkably improving the nationwide literacy of morality, scientific culture and healthiness ...forming a learning-style society, promoting lifelong education among people and accelerating all-round development of the people”. According to this strategy, China Association for Science and Technology (CAST) together with related ministries and commissions, jointly drew up a long-term state plan of “ Project 2049” with a view to the development in next 40-50 years. The goal of Project 2049 designed is that all Chinese people will be qualified with essential

scientific and cultural literacy at the 100<sup>th</sup> anniversary of the People's Republic of China, which will be propelled step by step by all the governmental or non-governmental organizations, enterprises and communities on the basis of national situation.

The establishment and implement of Project 2049 are aimed for the whole nation. However, the youth should be paid special attention, because their science literacy not only represents that of the nation but also represents the scientific level of China in the future. Therefore, the Working Department of the Adolescents of CAST has made up 《Project 2049 on Building the Science Literacy of Chinese Adolescents》. The improvement of science literacy needs the combination of various measures such as scientific popularization, mass media communication and the construction of stadium facilities. Anyway, education is a fundamental way out. At present, the science literacy level of Chinese adolescents is far from satisfactory and unanimous problems exist in school scientific education. After making the strategy of developing the city by relying on science and education, the education on students' qualities in Shanghai is being carried forward vigorously including the introduction of “expanding type”, “research type” and technical courses in the second round curriculum reform, which has laid the foundation for upgrading science literacy of the youth. However, there are still some bottleneck-like problems difficult to solve, so the Working Department of

the Adolescents of CAST chose Shanghai as a pilot city to play an exemplary role in the country.

With the advantage of its experience and strength in mobilizing and integrating social scientific forces, Shanghai Association for Science and Technology (SAST) shoulders the responsibility for promoting the science literacy education of the youth as well. The first stage of this project has been basically completed since it started in 2003. The results and experiences achieved account the reference value for improving the scientific education of the youth. This article will stress on analyzing the spreading process and methods of this project, and make some successful practical examples between scientific and educational fields.

## **The Process of Science Popularization**

### **1. The Conception of 2049 Shanghai Pilot Project**

(1). Understanding the situation of scientific education of adolescents.

Traditional Chinese culture has been paying great attention to the training of the next generation. Scientific education at schools has also drawn close attention from the people. However, a great deal of research and practice show that the science literacy status of Chinese adolescents is far from satisfactory. Who is a man with science literacy? According to scientists, that should be a man who at least has certain scientific knowledge, who can solve problems with basic scientific methods and

who possesses scientific spirit. However, for a long period of time, scientific education has focused more on textbook knowledge than scientific practice and understanding to the essence of scientific spirit. As a result, many youngsters lost their interests in science. For that reason, educational circle are now vigorously undertaking curriculum reform and textbook construction including scientific contents. Scientific education is getting rid of the bondage of old ideas rapidly.

Why should project 2049 stress the participation to scientific education for adolescents by scientific circle? There are complicated reasons for the poor science literacy of adolescents, which involve every field of scientific education. But many domestic and foreign experts believe that among all the problems related to scientific education, scientists' distance to education, the separation between educational and scientific circles, students' lack of opportunity to get in touch with real scientific research and technological practice have posed great obstacles to the full development of adolescents' science literacy. These problems exist not only in China. Many countries in the world including developed countries are facing the same bewilderment. So one of the important research targets for the improvement of scientific education and promotion of science literacy of adolescents is to construct a bridge between scientific circle and educational circle, engage scientists in scientific education, and involve live science and technology in scientific education of adolescents.

(2) Establishing the core concept of massive combination of scientific circle and educational circle.

The goal of 2049 Shanghai Pilot Project is to find out an effective way in promoting the science literacy of youngsters through many years' effort by combining scientific circle with educational circle. It should be realized that 2049 Shanghai Pilot Project is not the whole content of scientific education; it is only a component of the big system of scientific education of adolescents. Taking into account of the current situation of scientific education of adolescents in our country and also SAST as the main undertaker of 2049 Shanghai Pilot Project who has the advantage in mobilizing scientific strength, the project emphasizes how to link science and education closer to avoid unreasonable separation between them. Based on above realization, 2049 Shanghai Pilot Project has set up two core concepts:

**\*Massive Combination of Scientific and Educational Circle**

**\*Scientists' Entry to Classrooms.**

Why the massive combination of scientific and educational circles is needed? First, science always has two functions of exploring the natural law and educating people, so scientists and engineers should share the social responsibility of paying attention to and actively participating in scientific education of adolescents. Second, without the attention from scientific circle, scientific education of adolescents will not get rid of the

situation of separated science and education. Third, such an “action plan” initiated by scientific circle will succeed only by receiving the overall support and participation of the educational circle.

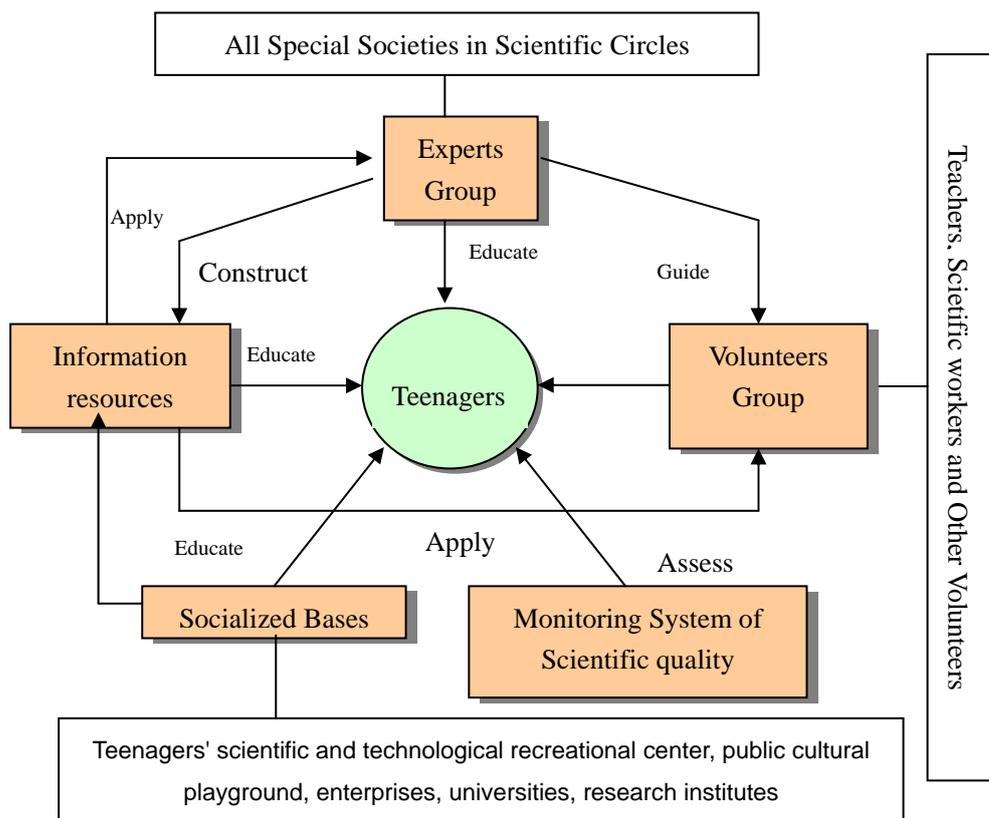
What the significance of “Scientists’ entry to classrooms”? Classrooms and schools are the most important fields of scientific education of adolescents. Without participating in school education and classroom teaching, scientists cannot impose greater impact on scientific education of adolescents. Neither scientific circle can make greater contribution to it. Scientists’ entry to the classroom has broader meanings. There are several ways for scientists to involve in classroom teaching, for examples, to write various kinds of science education materials for the students, to launch popular science lectures in schools, to train school science teachers and to guide students’ scientific research and technological invention, etc.

## **2. The Basic Task of Shanghai Pilot Project: Building Socialized Ecological Resources in Scientific Education of Adolescents**

The practical activities that 2049 Shanghai Pilot Project will carry out are mobilizing scientific communities to provide broad, open and progressive scientific teaching resources for school education, boosting the cooperation between scientists and teachers in scientific education, that is, to build socialized ecological resources in scientific education of adolescents. The socialization means the openness of resources

construction and usage, which is not the work done by just a few people or organizations, but the extensive integration of social resources. The ecology refers to the resources with the characteristics of interior coordination, exterior balance and sound development in the future. The socialized ecological resource of scientific education of adolescents is an complete system including information resources (such as students' learning material bags, online resources) and human resources (such as experts group of scientists, engineers), etc.

The construction of socialized ecological resources in scientific education of adolescents serves as a platform providing diversified information with abundant content for adolescents in their science study, creating more opportunities for them to participate in various scientific activities and communicate with scientists and engineers. With this platform, scientists can join in school scientific education from all aspects and teachers will have a broadened vision of science and technology, obtain new educational ideas, new teaching content and methods and get themselves upgraded while extending new type of scientific education to adolescents. The following figure describes the basic system structure of socialized ecological resources of scientific education of teenagers and reflects all the components of this resource and relations among these components.

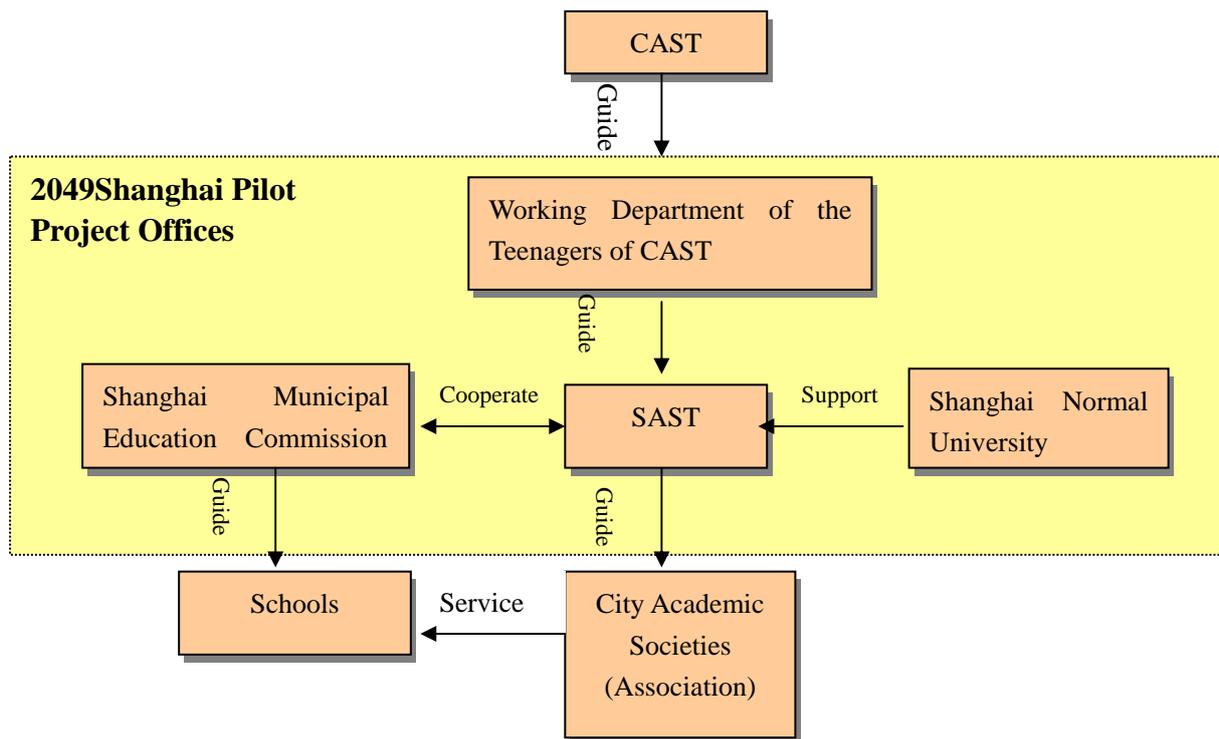


### 3. Mechanism of “Different jobs for an allied cooperation”

Under the direct leadership of Working Department of Adolescents, CAST, an office for 2049 Shanghai Pilot Project has been set up which serves as the promotion agency for the project. It is made up by the related departments of CAST, SAST, Shanghai Municipal Education Commission and Shanghai Normal University and so on. Each partner will urge its subordinates to accomplish related tasks (These subordinates are Science Popularization Department, SAST, Department of Basic Education and Department of Education Research, Shanghai Municipal Education Commission, Department of Basic Education and Scientific Planning and Dissemination Center, Shanghai Normal University). They

will also send their staffs to work in this office. Meanwhile, a systematic teachers' network and students' communication network will be established at the pilot schools.

The characteristic of such a working system can be described as "Different jobs for an allied cooperation". In this alliance, different partners will give full play to their advantages and play different roles in the implementation of this project. For instance, SAST is responsible for mobilizing and organizing scientific societies and experts to participate in the work of Shanghai pilot project; Shanghai Municipal Education Commission gives strong support for the project to go into classrooms, selects the pilot schools for the project, and organizes teachers to engage in the project; and scientific education experts sent by Shanghai Normal University offer support of the theoretical research about the project. The following sketch is drawn on the outline of the working mechanism in Shanghai pilot project.



#### **4. The Interface for Scientific Circle to Participate in Education: “Expanding Type” Curriculum**

A new round of curriculum reform is being carried out in Shanghai. It is composed of three parts with “foundation type”, “expanding type” and “research type”. Among them, close inner link exists between the purpose of expanding type curriculum and Shanghai pilot project. And expanding type curriculum needs urgently both the input of new teaching resources and the leaning resources of scientific fields. Lack of resources cannot be solved in a short time with the sole effort by educational circle. Therefore, while building “expanding type” curriculum, educational circle pays much attention to looking for social support. Taking “expanding type” curriculum as an interface for scientific circle to participate in scientific

education will not only help accomplish the basic tasks of the project, but also bring the advantages of scientific circle into full play and meet the needs of both schools and teachers.

## **5. Creating Scientific Information Storage**

### (1) Position of this storage

The information storage is a supplement to formal school curriculum and the main media for scientific circle to take part in scientific education as well as a new carrier of science literacy education for adolescents. Combining with the second round of curriculum reform, it encourages scientists to enter classrooms to teach science so as to involve current high-tech in middle and primary school scientific education, to stimulate students' interest in science research and help them learn new methods for science research, to equip them with critical innovation capability and irradiate their thinking on scientific value.

### (2) Content of this storage

The content of this storage should reveal both the development level of modern science and technology and the characteristics of Shanghai. Taking full advantage of the practical experiences of scientists and engineers, it should pay close attention to scientific research method and scientific spirit and broaden the adolescents' scientific vision. More than 170 societies affiliated to SAST can provide related statistics to the storage construction.

### (3) Form of this storage

It takes a concise form of module and topical subject to spread scientific knowledge to the students. Every topic with independent text, open to the students' choice, can provide various forms of combination. This form enjoys high flexibility which enables new scientific content to join school education in time so that the accommodation and effectiveness of this storage can be improved.

### (4) Structure of this storage

The storage consists of three parts: students' material storage (study material and practice material), education support material storage (education assistance material and multi-media material) and network material storage. The storage assumes a topical form which is convenient for flexible usage and modification.

### (5) The development of this storage

A construction team for this storage will be established, which will organize scientists and educational experts in a joint effort to develop the information storage. It will also encourage social communities to participate (TV station and publishing house, for instance) and try to input advanced educational material from other countries (translation of some excellent educational material and copyright input, for instance).

## (6) Application and maintenance of this storage

The storage needs continuous renewal and maintenance with the development of science and technology. The construction team will organize periodical meetings of expert group, listening to their advices so that out-of-date contents in the storage can be replaced with new material to guarantee its advanced and practical characteristics.

## **6. Organizing expert group**

Scientists, technical experts will form an expert group to train volunteer teams dominated by a large number of middle and primary school teachers, carrying out full-scale and interactive scientific education.

### (1) The nature of the expert group

Aimed at making contributions to the promotion of adolescents' science literacy, this group, a non-profitable, non-permanent institution, is established on the basis of participants' own will. What the experts in this group are doing is a kind of commonweal job, but they can get subsidies in accordance with their labor cost. The 2049 Shanghai Pilot Project Group will publicize members of the expert group and their working record and award them with honorary certificates for their generous contributions.

### (2) Business of the expert group

As the main builder of the information storage, the expert group takes the

task of training volunteer teams and teaching adolescents directly. It is the key point in the socialized ecological resource structure of 2049 Shanghai Pilot Project and also the bridge to combine all sides as an organic unity.

The business of the expert group includes:

I. To participate directly in the construction of scientific information storage for adolescents.

II To turn teachers and volunteers into qualified teachers by means of demonstration teaching, lectures and network communication and to encourage the establishment and enhancement of volunteer teams.

III To grant direct education to students with various forms according to practical conditions. For example, experts can deliver lectures to students; explain their scientific experiences to them and open network lessons.

(3) Members of the expert group.

Shanghai not only has many well-known universities, diversified institutions of high education, numerous professors and scholars learned in scientific fields but also has a number of powerful research institutes and key national laboratories covering the fields of IT, mining engineering, electronic engineering, construction engineering, transportation engineering, aviation and space flight, electronic machine engineering, food engineering, life science, mechanical engineering, chemistry and chemical engineering, material science, automation, energy, power engineering, agriculture science, light industry, handicraft industry,

etc. On the other hand, Shanghai boasts a batch of scientific workers who have won national scientific prizes, such as advanced scientific workers of scientific information, top national scientific award, and national prize for natural sciences, etc. All of them including those who have retired are qualified to be members of the expert group.

#### (4) Operational mode of the expert group

I. Construct an integrated expert resource system for 2049 Shanghai Pilot Project. With the advice from experts and educational departments, determine in batches the overall direction of adolescents' scientific information storage (ASIS).

II. Select necessary experts in accordance with different topics of ASIS, determine the topics and concrete construction plans of the information storage, and guide practical undertakers to complete the construction of information storage.

III. Experts are in charge of selecting, training and guiding volunteers who then will help overcome difficulties in scientific education. The expert group is likely to provide direct guidance to the adolescents if necessary.

IV. Members of the expert group are subject to necessary replacements to make sure that the group works effectively.

## **7. A Research on the Socialized Monitoring to and Assessment on Adolescents' Science Literacy Development**

This socialized monitoring and assessment are neither traditional examinations nor the tool of monitoring individual student development. Through the collection and analysis of materials from samples and cases, the assessment on the development level of adolescents' science literacy will be given. At the same time, serving the project itself, this system can make scientific and objective analysis on the outcome that the project has made and get feedbacks in time about the operation of various tasks. Meanwhile, it is required to lay a basis for the long-term monitoring to adolescent's science literacy.

The monitoring system has both “exterior” and “interior” functions. In terms of exterior function, it is an instrument to evaluate the adolescents' science literacy level in Shanghai. As to the interior function, it is a method for self- assessment. The establishment of measuring tables and moulds is the main target of the monitoring system. For a long-term project that will cover more than 50 years, it is necessary to build such a serious and standard measuring table, which is apparently influenced by regional culture and economic development characteristics. Standard and efficient assessment and feedbacks will also be introduced to various items listed in this project, such as “information resource storage”, “expert group”, etc. The basic point is to ensure a healthy development of

the project. The construction of the monitoring system to adolescents' science literacy level in Shanghai and other work of this project will be carried out simultaneously. Primary construction and adjustment of various sub-systems are main jobs of the first stage.

## **Results and Assessment**

### **1. Massive Participation, Massive Benefit.**

According to incomplete statistics at present, 30 city-level academic societies in Shanghai have involved in 2049 Shanghai Pilot Project, accounting for one fourth of the total society numbers. More than 500 scientists have also got engaged, most of them are outstanding scientists who enjoy leading positions in their discipline fields. 43 schools from 19 districts and counties in Shanghai have been chosen the pilot project schools, almost covering the whole area of Shanghai. By September 2004, over 30,000 students have selected the curriculum of 2049 Shanghai Pilot Project.

### **2. Material Bags Take Shape**

The material bags are compiled in batches. By the end of 2003, Shanghai Pilot Project has presented in two batches a total of 21 material bags featuring scientific highlights and topics favored by students. Multimedia discs made attentively by scientific experts are attached to every material bag. Fudan University Press has published these material bags and the

third batch is being compiled. The table below lists titles of these bags and the academic societies that made these bags.

### The First and Second Batch of Material Bag

Name of Society	Title of Material Bag
Shanghai Society of Automation	Automation Technology Irradiated by Mankind and Animals
Shanghai Society of Industrial and Applied Mathematics, Shanghai Society of Mathematics	Mathematical Mould for Decision Making in Competition & Risks
Shanghai Nuclear Society	Nuclear Energy Technology
	Nano Technology Is Changing Human Life
Shanghai Society of Spaceflight	A Golden Key to Open the Door of Space
Shanghai Society of Genetics	Gene Engineering
Shanghai Society of Traffic Engineering	City Life and Intelligent Transportation
Shanghai Society of Environmental Science	Save the Earth—City Development and Environmental Protection
Shanghai Society of Immunology	Biological National Defense
Shanghai Society of Geophysics	The Call of Poles
Shanghai Association for Science Promotion Publications	TV Technology and Modern Mass Media
Shanghai Society of Chemistry and Chemical Engineering	Water and Human Life
Science Promotion Committee, Shanghai Society of Preventive Medicine	Antiseptic Medicine—The Weapon to Counter Bacteria
Shanghai Society of Motor-vehicle Engineering	Research on Humanized Automobiles
Shanghai Computer Society	Will Computers Defeat Human Being?
Shanghai Medical Society	Radiation and Health
Shanghai Fire Prevention Society	A Book of Fire Prevention Knowledge
Shanghai Society of Entomology	Entomology and Bionics
Shanghai Astronomic Society	Journey to Learn about the Solar System
Shanghai Agriculture Society	Modern Agriculture Science and Technology
Shanghai Society of Meteorology	Weather and Weather Forecast

### The Third Batch of Material Bag (under production)

Name of Society	Title
Shanghai Society of Zoology	Animals and Mankind
Shanghai Society of Civil Engineering	Basic Knowledge of Bridges
Shanghai Society of Laser	Miraculous Light
Shanghai Society of Navigation	High Seas Ship—Floating Cities
Shanghai Metal Society	Entering Steel and Iron World
Shanghai Society of Psychological Hygiene	What's in My Mind?—Research on Individual Psyche.
Shanghai Society of Railway	The History and Future of Railways
Shanghai Society of Communication	Information and Communication
Shanghai Society of Naval Architecture and Marine Engineering	Science and Technology of Ships

### **3. Provide Training to Scientific Teachers to Propel Their Specialization**

It is proved by experiences that the success of education depends largely on the quality of teachers. Without upgrading the quality of massive scientific teachers at the front, it will be impossible to reach the targets of 2049 Shanghai Pilot Project. Therefore, one of the most important ways for “Scientists’ Entry to Classrooms” is training scientific teachers. The project has organized two training programs in 2003 and 2004, inviting scientists to deliver series of lectures on the material bags. These lectures featured flexible and practical patterns which enabled teachers to choose different content according to their own interest and demand.

These training programs have gained praises from scientific teachers who actively participated in, and more than 1,500 teachers have been trained.

#### **4. Establish 2049 Pilot Project Website**

Taking advantage of modern information technology, the website will enable more and more teachers and students to share adolescents' scientific education storage of 2049 Shanghai Pilot Project. At the same time, it will strengthen the communication between this project and societies, scientists, schools, teachers and students. The establishment of the website is the only way for 2049 Shanghai Pilot Project to maximize its efficiency. The domain name of this website, which has taken an initial shape, is [www.2049sh.org](http://www.2049sh.org)

#### **5. Prepare to Build Socialized Bases for Adolescents' Scientific Activities**

The scientific education of adolescents should take full use of social locations of scientific education if it wants to go out of school. At present, there are quite a few bases of adolescents' scientific activities in Shanghai. But for some reasons, few of them have played their roles. So it is one of the most important tasks of 2049 Shanghai Pilot Project to build socialized bases for adolescents' scientific activities.

These bases should feature clear characteristics of the 2049 project and keep in line with the key tasks of the project. Therefore, the first batch of bases will be developed according to the requirements of material bags. The idea of "Massive integration of scientific and educational circles"

should prevail over the construction of these bases, so that the cooperation among scientists, teachers and undertakers can be realized. Different bases will receive different guidance. Bases under preparation now are as follows.

Name of Society	Title of Material Bag	Bases
Shanghai Society of Genetics	Gene Engineering	复旦大学生命科学学院
Shanghai Society of Immunology	Biological National Defense	上海市免疫学研究所
Shanghai Society of Preventive Medicine	Antiseptic Medicine—The Weapon to Counter Bacteria	上海市公共卫生中心
		复旦大学药学院
Shanghai Medical Society	Radiation and Health	复旦大学放射医学研究所
Shanghai Agriculture Society	Modern Agriculture Science and Technology	上海孙桥现代农业联合发展有限公司
		上海市农业科学院科普教育基地
Shanghai Nuclear Society (Nano)	Nano Technology Is Changing Human Life	上海师范大学生命与环境科学学院
Shanghai Nuclear Society (Nuclear Energy)	Nuclear Energy Technology	秦山核电站
Shanghai Astronomic Society	Journey to Learn about the Solar System	上海天文台佘山站
Shanghai Society of Motor-vehicle Engineering	Research on Humanized Automobiles	上海工程技术大学汽车工程学院
Shanghai Society of Entomology	Entomology and Bionics	中国科学院上海昆虫博物馆
		上海大自然野生昆虫馆有限公司
Shanghai Society of Chemistry and Chemical Engineering	Water and Human Life	上海获特满饮料有限公司
		华东理工大学资源与工程学院
		Chemistry Department, Fudan University
Shanghai Fire Prevention Society	A Book of Fire Prevention Knowledge	嵩山消防中队
		天山消防中队
Shanghai Society of Industrial and Applied Mathematics	Mathematical Mould for Decision Making in Competition & Risks	上海应用数学中心
		上海海事大学基础部
Shanghai Society of	Save the Earth—City	上海浦东美商生物高科技环

Environmental Science	Development and Environmental Protection	保有限公司
Shanghai Society of Automation	Automation Technology Irradiated by Mankind and Animals	上海市第二工业大学实训中心
Shanghai Society of Geophysics	The Call of Poles	极地科普馆
Shanghai Society of Meteorology	Weather and Weather Forecast	上海市浦东新区气象局
		上海市气象知识科普教育基地
Shanghai Computer Society	Will Computers Defeat Human Being?	上海超级计算中心
Shanghai Society of Spaceflight	A Golden Key to Open the Door of Space	上海航天科技工业展示馆

## Discussion

### 1. “Massive Integration of Scientific and Educational Circles” is rather the Essence of Scientific Education than a kind of form.

In past practices, experts, teachers and undertakers involved in 2049 Shanghai Pilot Project had the same feeling: a real integration of scientific and educational circles is the key to promote adolescents' science literacy and also the key to the success of 2049 project on operational level. In the field of scientific education, both scientific circle and educational circle bear indispensable responsibilities though their tasks have different focuses. Therefore, the integration of scientific and educational circles is not a kind of form, but rather the essence of scientific education. People in scientific circle should provide earnest service to education and search for more effective ways for this service while people in educational circle should give full trust to their

“comrades” in scientific circle, help them learn more about education and obtain successive nutrition from those scientists.

## **2. An Cooperative Mechanism Enables the Project to Develop Efficiently**

2049 Shanghai Pilot Project has disposed the old system in which scientific circle and educational circle practiced independent administration to their tasks and never integrated with each other. Instead, it has taken a new public appearance now with scientific circle and educational circle making joint decisions, organizations and implementations. Thus, the two sides can benefit from mutual advantages and eliminate for certain degree the contradiction and inefficiency caused by separation of administrations.

With this cooperative mechanism, 2049 Shanghai Pilot Project is developing smoothly and rapidly. And a real cooperation between scientific circle and educational circle has established. It is predictable that certain problems will appear in the current mechanism as the project goes forward. Moreover, its adjustment and innovation is needed for further development of this project. So the form and area of “cooperation” might be expanded and enhanced. Anyway, the cooperative mechanism should be preserved and further developed.

### **3. Action and Research Interact with Each Other; Keep Vitality with Creation**

2049 Shanghai Pilot Project is a kind of “action and research” program. That is, the project should not only base itself on action, but also insist on research so as to find out problems, solve problems and reveal laws. We should pay attention to two experiences. First, in the start-up period of this project, we need to do a lot of research including theoretical research and feasibility analysis to make a good overall plan. Second, we should make continuous feedbacks and adjustments in operational practice and create innovative new ideas under the guidance of the overall plan. It is our persistence to the interaction between action and research that has made 2049 Shanghai Pilot Project develop rapidly. It is our focus on innovation in operation that has kept the vitality of the project. In the future, with the accumulation of our experiences on operational level, we should strengthen our research on theory and find out essential and universal laws so as to make further contributions to a scientific, reasonable development of adolescents’ scientific education.

### **4. Problems to be Solved**

- (1) Promotion of adolescents’ science literacy is the fundamental purpose to implement 2049 Shanghai Pilot Project. However, how do we know that the project has made some progress? So it is very important to formulate an assessment system on

educational effects. Naturally this system should feature characteristics of 2049 Shanghai Pilot Project. But how to integrate it with original school assessment system or to avoid repetition and conflicts? How to prevent it from becoming students' "burden"?

The planned "Monitoring system to adolescents' science literacy of 2049 Shanghai Pilot Project" is aimed at making an objective description to the science literacy of adolescents in Shanghai through various monitoring and appraisal means. Up till now, we have formulated the "Construction Plan for the appraisal index system of adolescents' science literacy development level in Shanghai". Throughout 12 industries in Shanghai, we have carried out "a survey on social expectation to adolescents' science literacy development in Shanghai". We also made "a survey on current status of adolescents' science literacy development in Shanghai" in 29 schools. However, this plan still has some defects and its effectiveness has not been deeply analyzed. And we haven't found an effective way yet to get a unanimous public understanding to it. Moreover, it remains a problem how to integrate it with CAST's general expectation to citizen's science literacy standards. In a word, "assessment" is a very important but also very difficult subject.

(2) In the process of planning and undertaking 2049 Shanghai Pilot Project, Shanghai Municipal Government and all walks of life have provided active support to it. Schools are very enthusiastic to engage in it. But the roles of local government, society and schools should be more definite in such a massive operation. How the local government takes more and full use of the enthusiasm of scientific circle to involve in adolescents' scientific education? How all walks of life turn their enthusiasm into more effective action? No doubt schools are key places for adolescents' scientific education, should they enjoy more chances to express their opinions and take more initiatives? Is it enough to keep a sustained development of this project just with fervor and a sense of responsibility?

## **Conclusion**

Practice has proved that with SAST acting as an organizer allied with scientific and educational circles, with 2049 Shanghai Pilot Project serving as an opportunity, it is a feasible way to propel school scientific education reform. If we work with a steady pace and a thoroughly considered plan, the reform is bound to get support of all sides. Thereby, a new platform and pattern to boost adolescents' scientific education reform with the joint effort of both scientific and educational circles will

be established, and a new mechanism for adolescents' science literacy training will also be constructed.

## **Acknowledgement**

Working Department of the Adolescents, CAST

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<<Project 2061>>, U.S.