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RESEARCH ARTICLE

The Connotation and Goal of Science Popularisation in Modern China

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ABSTRACT

The conceptual framework and practice of science popularisation in modern China are developing constantly. At present, science popularisation is usually considered to denote activities that disseminate science knowledge to the public, popularize scientific thoughts, carry forward scientific spirits, advocate scientific methods, constantly improve public-scientific literacy and communicate with the public for their all-round development in a way easy for them to understand, accept and get involved into the activity. Scientific methods, scientific thoughts, scientific spirits and relationships between science and society constitute the main ingredients of science popularisation. The main objective of science popularisation is to improve public-scientific literacy, promote communication between science and society as well as spread scientific culture.

KEYWORDS: Science Popularisation, Connotation, Goal, China

Introduction

The Chinese government has always considered science popularisation as a national priority. Early in the 1950s, when the government was engaged in the writing of the first draft of "the Constitution of the People's Republic of China", "popularisation of science and technological knowledge" was listed as a national objective. During the initial decades of national development and social construction, science popularisation remained a priority on the national agenda (Ren and Zhai, 2012).

The present century witnessed the promulgation of the "Law of the People's Republic of China on Popularisation of Science

and Technology" by the National People's Congress (NPC) in 2002 and the enacting of the "Outline of National Action Scheme of Scientific Literacy for All Chinese Citizens (2006-2010-2020)" by the State Council in 2006. These policy instruments helped to facilitate the fast growth of science popularisation in China. During this period, academic activities and conceptual innovations in science popularisation were constantly promoted by the rapid development of the Chinese economy and society as well as the gradual establishment of a diversified and personalized socio-culture background.

The connotation of science popularisation evolved as the Chinese society changed during its process of historical development. At present, science popularisation is considered to be a set of activities to disseminate science knowledge to the public, spread scientific thoughts, carry forward scientific spirits, advocate scientific methods, constantly improve scientific culture and ensure all-round development by communicating scientific ideas in a way easy for public to understand, accept and get involved in the developmental processes. The connotation of 'science popularisation' in China is comparatively more localized and indigenized than that of 'public understanding of science' or 'science communication' referred to in the context of western countries.

Development of Science Popularisation

For a long time after the establishment of People's Republic of China (PRC), science communicators in China interpreted science popularisation as an activity to be carried out for national economic reconstruction and to communicate achievements of scientific and technological carried out by the scientists to the public for increasing national productivity. After China's opening-up and reform, scholars started re-examining the notion and praxis of science popularisation and found it to be narrowly focused on transfer and application of technology in economic development and daily life. The understanding was merely based on utilitarianism.

The re-examination gained momentum in the 1990s out of two reasons. One, during this period intellectual discourse began to increase among Chinese scholars – they exchanged ideas with the international academic community. The second reason is, that the realization a tidal wave of feudal superstitions, anti-science and pseudoscience was sweeping many regions of China. This created confusion and was considered to be a potential risk to the society. Superstitions were spread frequently and affected people's ideology in many different ways. For example, a myth was spread that 'water could be changed to oil' (Shen, 2003; Zhu, 2001).

People could not help but question the efficacy of efforts made in science popularisation. The basic was why so many problems still persisted even after decades of development in science popularisation. Scholars debated the issue and concluded that science communicators, while popularizing science, disparaged the spirit of science (Chuanhong, 2010). In April 2000, Chairman Jiang Zemin pointed out the gist of science popularisation; this is to "Promote scientific sprit, popularize scientific knowledge and spread scientific thought and method" (Jiang, 2012?). This was a statement that introduced the ideological basis for science popularisation.

At the beginning of the 21st century, the debate became more active and even more fierce. Some scholars pondered further on the issue and proposed to replace the term 'science popularisation' with the more international term 'science communication' (Yin, 2010). They thought the social function of science was changing and the idea of science popularisation was changing as well – from one-way communication to two-way interaction between citizens and scientists; the intervention of government and media changed the mode of science popularisation to social engineering (Wu, 2003).

However, a few other scholars argued that it was not a matter of which term is used (Wu, 2003). The contents and forms of science popularisation were developing constantly. Innovation of

ideas was more important than just replacing 'science popularisation' with a fashionable term. Actually the notion 'science popularisation' has by now absorbed a number of emerging or fresh ideas from 'science communication' or 'public understanding of science' research (Yin, 2010). Some scholars re-analyzed science popularisation not only from the academic perspective but also from the public's point of view (Yin, 2010). They argued that science popularisation should be public-oriented, and this helped to deepen and broaden the scope of connotation of science popularisation.

Contents of Science Popularisation

Science knowledge

The two ends of the science popularisation continuum, i.e. science communicators and citizens, work together towards the same objective. Communicators propagate scientific knowledge and citizens seek the same. This process leads to a wider dissemination and absorption of scientific and technological information generated by the experts to the public. The underlying presumption, essentially, is that science communication will lead to enhanced levels of citizens' scientific literacy, thereby helping people to improve daily life, labour skills, increase problem solving ability and increase the quality of their life. Scientific information, once it becomes a part of cognitive structure, also improves public participation in policy debate.

Scientific methods

Dissemination of scientific and technological knowledge is necessary but not a sufficient condition for creating a scientifically driven society. Science communication must aim at inculcating scientific method among the public. However, information dissemination helps citizens to understand 'methods' that scientists use in order to achieve the research results. These are basic tools and means that lead scientists to innovate, invent, discover and formulate postulates, tenets and laws of science.

Therefore, it can be argued that methods are more quintessential and germane to scientific knowledge compared to the scientific information, which is tentative at any given point of time.

It is important to communicate the scientific method while communicating science, for the simple reason that conveying scientific facts, information or even laws may not inculcate scientific temper among the citizens. These may replace the old belief and superstitions but may not invoke the sprit of scientific enquiry. The method of science, once popularized along with scientific information, will lead to its invocation beyond the scientific domain i.e., during the course of quotidian life and solution of problems that a common citizen encounters. This will also result in a better appreciation of distinguishing features that mark science and pseudo-science.

Scientific thoughts

Scientific thoughts are ideological elements of science. Different from specific knowledge and method, scientific thoughts constitute an overall view about this sphere of human activity and corresponding ideas that remain hidden behind knowledge and methods. Scientific thoughts originate from research activities and direct the follow-up research activities.

Based on science, scientific thoughts direct the process of scientific research as well as the design and use of methods. Therefore, thoughts are more advanced elements than specific knowledge, theory and the methods. Refining scientific thoughts relies on generalizing and advancing science knowledge, theories and methods. However, through science popularisation, once refined, scientific thoughts are communicated more easily than specific knowledge and theories. Because usually dissemination of science knowledge involves use of concepts, terms, formulas and rules, but few technical and mathematical words are required when scientific thoughts are disseminated, thus they are easier for the public to understand. For example, it may not be easy for the lay public to learn the ‘Bing Bang Theory’, but at the ideological level, if it is conveyed to the public that the universe

originated from a big bang, which happened 13.75 billion years ago, the public realizes that the universe is the result of material evolution. The underlying ideological divergent positions between the materialist ideological position operating behind the theory of 'Big Bang' and metaphysical 'Theory of creation' could be easily communicated and understood.

For the ordinary public, it is hard to grasp all scientific knowledge and theories, and it is also unrealistic to expect the public to know a certain specific theory in detail, but the public can understand and grasp ideological positions (Liu, 2005). Understanding and grasping scientific thoughts will benefit the public to grasp the nature and spirit of science, improve their scientific literacy and increase their rationality. Chairman Mao Zedong said "our compatriot had blind faith in god and ghost, in images, in fate and in power…all that was the result of absence of scientific thoughts"[1]

Scientific spirit

Scientific spirit here refers to the cognition of accumulated scientific knowledge. It puts a regulatory check on scientific understanding, and in turn, regulates the direction of science and the process of scientific practice. Broadly speaking, the contents of scientific spirit are not only apt for directing and shaping scientific practice of scientists, but can also guide and regulate the consciousness and practice of everyone in society.

Many scholars have made efforts to articulate the notion of scientific spirit in different ways. Most of these are compatible and complementary in nature. For example, some people generalize scientific spirit as rational spirit of exploration, realistic spirit of experimental evidence, enterprising spirit of innovation, and inclusive spirit of competitive collaboration. Some generalize it as objective truth-seeking spirit, constant spirit of inquiry, spirit of pursuit of truth, scientific skepticism

[1] The declaration of the first issue of Xiangjiang review [n]. http://hxd.wenming.cn/zhuanti/jg60nian/2009-02/12/content_22374.htm.

and spirit to collaborate; some as true spirit, rational spirit, critical spirit, spirit of equality and spirit of collaboration; while some as exploring the truth, advocating the truth, innovation, opposing superstition and blind obedience, emancipating the mind, pursuit of truth, and advancing with the times (Sun, 2011).

Scientific spirit is universal and not only cuts across the scientific discipline but also all human endeavours. It is rooted in the modern scientific and technological development and essential to build a scientifically tempered society. Science popularisation efforts must inculcate the scientific sprit among the common citizens while communicating information, knowledge and method of science. Communicators of science should fulfil the responsibility of helping people to imbibe and grasp scientific knowledge, worldview, ideology and spirit. The process of internalization is slow and labour intensive, for two reasons, firstly, because the steps involved are complex, and secondly, the ever changing and expanding universe of scientific knowledge demands ceaseless, creative and consistent popularisation of science.

The relationship between science and society

Science and technology is a subset of the social system. It affects the social system within which it exists and is also affected by the social systems. The understanding of basic dialectical relationship between science-technology and the society is needed to determine the direction of social as well as scientific development. Any intervention — such as science and technology popularisation — may not yield the desired results unless a sound understanding of this complex relationship is arrived at. It should be noted that this relationship is external to scientific knowledge. In other words, the science-technology-society interconnection may not depend on ‘core elements’ of science, that is, on scientific knowledge, methods, thoughts and spirit of science. The relationship is essentially a complex function of historical accumulation of all that scientific and

technological knowledge in general and a history of science and technology in a given society in particular. It also depends on the present level of scientific literacy and future trends that are likely to influence and shape social developments.

It is through the knowledge and understanding of the history of science and technology development, present status, and future trends that a people develop an appreciation of the entire domain of scientific activity. The knowledge of how important discoveries and inventions have been made helps a common citizen to recognize the patterns that define scientific knowledge and also appreciate the influence that the discoveries have had on human civilization. The acknowledgement of changes that these discoveries and inventions have brought about in other spheres of human endeavour such as economy, politics, culture and education and how the factors operating in these spheres have influenced the course of scientific quest lead a citizen to recognize the importance of understanding the scientific developments and their influence on their individual and collective quotidian life.

The relationship between science and society is of prime importance to both, science communicators and the lay public. Basic scientific knowledge about facts and figures may not be of direct interest to a layperson but once s/he realizes what influence it is likely to have on the present and future of the individual, collective or the entire human race, then it would be natural for s/he to seek information and absorb it within the cognitive structure of thought. Thus, by communicating the past, present and future impact of science, a communicator is likely to create an urge among the common citizens for seeking more information on subjects of interest and importance. The information once sought for will, on the one hand, increase the scientific literacy level in the society, and on the other hand, generate public debate, that will lead to democratization of the policy-making process.

Once common citizens develop the capability to participate in the policy-making process, it will lead to a chain reaction.

They will also develop the potential to understand how things work at the macro (international and national) as well as micro (regional and local) level, and what role science and technological progress plays in shaping international relations, national problem solving processes, overcoming regional imbalances and personal life. The knowledge of the current status of national scientific capabilities will lead to better-informed choices for future development. The social dialogue on issues of vital importance will help common citizens to lend support to the government, industry and scientific community in their endeavour to achieve national objectives.

The controversies in science need a larger democratic-public debate. It has been repeatedly observed that, in case the public-scientific-literacy is low, policymakers, scientists and the public do not understand each other's perspective and a meaningful dialogue does not take place. More often than not this situation causes social tensions. In order to resolve such issues it is necessary to increase the level of science literacy as well as appreciation of external factors that constitute causal effects on social, economic and political development.

Demand for Science Popularisation in China

Let us modify the 'transmitter model' of communication and consider only the supply side and demand side of the entire process of communication, which is designated as transmitter and receiver in the proposed model (Zhu, 2001). Let us also consider that in the Shanan and Weaver model, the transmitter and receiver are not dumb mechanical devices but are representation of human collectives and individual citizens, who exist and operate in their social, economic and cultural spheres. Then it can be argued that there is great demand for science popularisation in China.

The ultimate objective of all science popularisation programmes in People's Republic of China is to meet this

demand and aspiration of the Chinese people. Science popularisation in China is driven by two types of demands: one is the national demand and the other the social demand. The latter includes the public demand (Ren and Xie, 2012; Ren, 2010; Xie and Ren, 2009; Xie, 2011).

Centered around the national strategic development plan, the nation put forward the demand for science popularisation, which mainly reflected in the contents of science popularisation for the entire society. The basic expectation of 'national demand' for science popularisation is to establish a socio-cultural atmosphere and develop a national strategy including allocation of resources, improving public scientific literacy, cultivating increasingly competitive human resources, promoting communications between science and the public, and promoting national innovation development as well as all-round progress. It is a typical Chinese national demand that 'the notion of ecology-civilization should synchronise with the actual development process of the society'.

Social demand includes the science popularisation needs articulated by the social groups and enterprises. Such demands vary a great deal in nature; for example, there could be a demand on practitioners of science popularisation to communicate information that will bring about safety awareness among the miners. In other words, these could be specific demands for career development. These demands could be met through internal training; however, many times science communicators are called upon to improve the efficacy of science communication.

An individual citizen has specific demands, which are determined by their regional, economic, cultural, and educational status and local customs. These demands show a greater variation in purpose, contents and forms. Every individual demand is microscopic in nature; however, a set of individual demands shows a distinctive group characteristic. Groups like

minors or farmers have specific characteristics in their demands, which constitute a group demand. For successful science popularisation, recognition of this category of demands is of prime importance.

In general, social science popularisation demand in modern China shows a strong utilitarian bias. Most citizens recommend that science popularisation should contain 'useful' knowledge such as healthcare, ways to become rich, and what knowledge will help them in their daily life. Citizens are less interested in 'not so useful' contents. They tend to ignore scientific thoughts and spirit, which apparently is not related to daily life or career development.

The historical juncture, through which China is passing, calls for a careful articulation of overarching national demand for science popularisation. This should take into account the social demands; however in a few cases, such demands put forward by the collectives or individual citizens may be at variance with the national demand. For example, the national call for energy conservation and low carbon life may be in contradiction with the collective or individual's way of life or aspirations of living standards. In case of enterprises and production houses it may require additional expenditure. In such cases the national demand should work as a guideline for all to follow. The national demand once carefully chalked out must be firmly and vigorously promoted to instil scientific rationality, thought, spirit and finally the culture of science (Ren, 2012).

Objectives of Science Popularisation

Promotion of scientific literacy

The primary objective of the Chinese science popularisation programme is to promote public scientific literacy. For an individual living in the modern times, hunting for a job, smooth daily life or realization of all-round individual development, it is necessary to acquire scientific and technological knowledge.

Chinese scholars firmly believe that scientific literacy is important in modern society. One can have rational scientific attitude, objectively understand the world as well as the nature of science, resist ignorance and superstition, effectively participate in social and political life, fulfil the role of a citizen and realize all-round self-development only with basic scientific literacy, armed with scientific knowledge, thoughts and concepts. The 'Outline of National Action Scheme of Scientific Literacy for All Chinese Citizens' lays out the plan for achieving scientific literacy for all Chinese citizens. The plan being implemented since 2006 will continue to guide science popularisation in China till 2020 (NSSL, 2006). It recognizes scientific literacy as an important element of citizen literacy and endorses the view that to improve public scientific literacy is not the responsibility of school education only, it is a social activity, which should be continued beyond school education, public should participate in it under the guidance of the government.

The twin structures, that is, formal science and technology education and science popularisation, must aim at improving science literacy significantly. The motto 'science popularisation for people's livelihood' guides science communicators to help people improve their living standards. This is an important objective at this stage of Chinese socio-economic development.

Promotion of scientific culture

To promote scientific culture is one of the most important long-term goals of Chinese science popularisation. Scientific culture is a structure of values based on scientific knowledge, method and rational scientific thoughts (Zhang, 2005). It is a subset that operates within broad modern advanced culture. In a multi-polarized world, where changes and adjustments are taking place at an ever increasing pace, where scientific discoveries and technological innovations frequently cross national boundaries, the social values and cultural systems also undergo a metamorphosis recurrently. Therefore, the 'National Outline'

places a significant emphasis on building a 'National Culture' based on scientific rationality, pragmatism, truth-seeking and constructive criticism[2]. It has been observed that science popularisation in China has started making a significant contribution towards building this culture.

Coordinating harmonious relationship between science, technology and society is a large project with structural and financial dimensions. Errors in execution can have profound impact on scientific and technological research. Research carried out by the scientific community requires participation, understanding and support from the entire society. Scientific research is closely interlinked with economic and social development and improvement of public life. Transforming nature through science can trigger significant changes in culture and value systems. General improvement of public scientific literacy has enhanced public participation in decision-making.

Chinese citizens are relatively more aware of their right to know that they seek strategic options and in some cases they have influenced science research to varying degrees. The intervention of individuals and collectives in decision-making is becoming relatively more intense. It is against this background that organizations dedicated to popularisation are making significant contributions by opening up new interactive channels of communication between science and the public. For example, the China Association for Science and Technology (CAST) regularly invites some scientists with social influence to approach the pubic to inform them of the latest developments in science and technology and some hotspots or common sense issues that will help the public to gain basic knowledge of science and technology. In a nutshell, this proves to be a way to construct a bridge between the government and the public in terms of promoting scientific literacy.

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[2] Outline of the National Scheme for Scientific Literacy [N]. http://www.gov.cn/jrzg/2006-03/20/content_231610.htm.

Discussion and Conclusion

Modern Chinese science popularisation is the result of a constant evolutionary process and shows three obvious features: succession, native trait and blending.

In the view of succession, for example, a key feature of modern Chinese science popularisation is that it contains confound connotation which can be seen as a result of re-examining of history to a great extent. In China, science and technology dissemination and popularisation in modern times started from the new cultural movement at the beginning of the twentieth century. It aimed at transforming thousands of years old Chinese feudal culture into western scientific and democratic culture. The movement awakened the citizens who for centuries were under the bondage of feudal ideas and inspired their wisdom, thus revitalizing the ancient Chinese civilization. Obviously, intellectuals of that time viewed science as a tool and a symbol of cultural transformation. In the last hundred years, the vicissitudes of Chinese society have changed. But, since the human consciousness is shaped by cumulative historical experience, some of the old notions are still influencing the thoughts and ideas about Chinese science popularisation.

China is a country with age-old historical and cultural traditions, overwhelmingly large population and significant regional imbalances. Strategies to bring about any changes in China without considering these factors are likely to fail. Chinese science popularisation focuses on scientific thoughts and spirits, which are closely intertwined with the practical needs of the people. Scientific rationality is not yet established among the Chinese citizens. Unscientific, irrational behaviour, superstition, pseudo-science and anti-science are still prevalent in the society, and some cases of irrational behaviour propagated by motivated groups endanger social harmony and stability. Therefore, it is not hard to understand the craving for scientific thoughts and spirits in Chinese society.

Three primary goals of Chinese science popularisation are to improve public scientific literacy, to promote the communication between science and society and to promote scientific culture. However, the primary objectives at a given historical juncture could be achieved by translating these into realistic achievable objectives. 'Science popularisation for people's livelihood', although it is highly utilitarian, matches with the current national developmental reality of China. China is a developing country, citizens are striving to improve their quality of life, and therefore science popularisation efforts must intervene to satisfy their aspirations. Regional imbalances, differing levels of social developments and complex social structures demands flexible and group specific strategies of science popularisation.

Chinese science popularisation keeps it eyes open to international developments. It has drawn a number of lessons from experiences and theories abroad. Since the late 1980s, the magazine *Research on Science Popularisation* has translated and introduced a great amount of literature and important papers on science popularisation that were produced abroad. For example, *Public Understanding of Science* by Sir Bodmer, European and American research reports on public understanding of science, STS theory, science popularisation in Germany, Japanese and Korean, the United States project 2061, European theories and practice of science dissemination, outreach activities by American Association for the Advancement of Science, chapters on public understanding and attitudes of science from *Science and Engineering Indicators* by NSF and the opinions of Nobel Prize winners on science popularisation have been translated and published in Chinese. This literature helps Chinese scholars to arrive at a deeper understanding of international theoretical developments in the area of science communication, and also stimulates debate among Chinese science popularisers, which in turn, has an important bearing on promotion of science popularisation in China (Ju, 2006), (Li, 2008).

Current Chinese science popularisation, which is characterized by the modern historical reality of China and draws from international experience, is no longer confined to traditional thought, forms and modes of communication. Conscious of deeper links between traditions and modern times, and position of China in a globalised world order, Chinese science popularisation is consistently involved in the process of introspection and evolution.

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