

266. Looking into the Theoretical Development of Science Popularization Studies in China

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Abstract. Science popularization, or science communication, holds its ground as a favorable cultural device long since the coming out of new China, but it was not until 1980's that science popularization studies in China stepped into the stage of theoretical integration.

This paper is intended to 1) briefly review the scenarios of science communication for the public in a span of 60 years in different cultural contexts, 2) trace down the developing path of science popularization studies at theoretical level by discussing the focusing issues occurring in the period of theoretical integration, 3) summarize the basic characteristics of science popularization studies in China.

Keywords: Science popularization, Science communication, Theoretical development

Introduction

Science popularization is a historically preferable phrase in China referring to the prevailing cluster of new concepts such as science communication, PUS, scientific culture, etc. The science popularization studies in China launched somewhat late as compared to the developed countries, and there are rather big gaps in depth and width in theoretical studies. Some researches are still at the level of narration of practical facts trying to find out some regularity, while there do appear some researches containing factors of theoretical analyses.

Division of Historical Development of Science Popularization Studies

Based on the references of divisions of science & technology history and science popularization development, the evolution of theoretical research on science popularization in China can be divided into three periods: "awareness of science popularization" period from the end of 16th century to 1949, "understanding of science popularization" period from 1949 to 1978 and "theoretical integration" period from 1978 till now.

The first period witnessed the coming out of science popularization. During this period scientific knowledge of western society spread eastbound and was localized gradually by Chinese culture. It started from the idea of

"Chinese culture the body, western science the limbs", then went further to the belief of "save the country with science", "scientism" and finally went to stillness in war times. The practicability and functionality of science were over emphasized in this period, while the value of scientific thoughts was not fully understood by the ordinary people. Nonetheless, it opened the door for science popularization in China.

In the second period, science popularization was carried out in the working pattern at national level. There were big steps in science popularization in China since the government provides beneficial conditions and powerful supports for the development of science and technology. Science popularization theories began to draw nutrition from the practice by summarizing successful experiences. Items concerning science popularization in science and technology policies were made and discussions about science popularization work were held intentionally in which theoretical factors can be found.

The third period is a consciously developing period of science popularization study. Influenced by the western science and technology communication theories, Chinese scholars and researchers started to learn and introduce western theories and try to merge local study with imported ones, that is, to analyze Chinese science popularization practice applying advanced western theories.

After the National Science Conference in 1978, some researchers put forward the thought of construction of "science of science popularization", that is to say, making science popularization a separate research domain.

Around 1990's, the first proceedings of science communication study were published and the theories of public understanding of science were introduced into China to the moment. Together with the rise of science and technology communication study brought along by Communication Science, a distinctive theory system of science and technology communication in China has come into being. This system was based on both critiques of "traditional

science popularization” thoughts and absorption of western theories by university scholars.

As it entered into 21st century, another hot spot appeared with the issue of Law of the People’s Republic of China on Popularization of Science and Technology (2002) and the Outline of the National Scheme for Scientific Literacy (2006). Studies on interpretation and promotion of “public scientific literacy” rooting in the measurement of which become the core subject of theory research on science popularization.

Theoretical Integration of Science Popularization: Multi-Dimensional Research Field

The science popularization in China entered into a new period after 1978. The contents, approaches and methods in science popularization study are very complicated without a common clue since there is very close connection between science popularization and science of communication, education, sociology and anthropology, etc. Discussion in this part is about the representative issues drawing the attention of most researchers in different developing periods of time with the new ones emerging but not substituting the old ones.

Attempt to construct science popularization as a separate discipline

Based on the experiences and lessons learned in science popularization practice in more than twenty years, construction of science of science popularization was proposed when science popularization began its redevelopment after 1978. Although the first monograph on science of science popularization was not published until 1989, there was already an article titled Probing into science of science popularization expounding what science of science popularization is in 1979, which initiated the study on how to construct the science of science popularization.

It was written in the article that, “There’s special rules in realizing speedy, correct and most effective popularization of different scientific knowledge and techniques for different objects, which has become a particular science.” Considered the differences between science popularization and other sciences, it was concluded in the article that, “The science of science popularization is a traversing science which studies the popular and common phenomena extracted from all other sciences.” Two kinds of researches were suggested to be studied, one is theoretical research, and the other is applied research. The contents of the former should be the history, position, function, motivation and cognizing discipline of science popularization, while those of the latter are the different patterns, rules and approaches of science popularization practices. The practices here include but not limited to science popularization propaganda, education, exhibitions and so on. In further discussion, science of science popularization was also defined as “a science studying and revealing the rules and corresponding dialectical relations of science popularization, and the way to grasp and apply these rules and relations for more effective science popularization.”

Inspired by Probing into science of science popularization, monographs such as Introduction on Science of Science Popularization, Conspectus on Science of Science Popularization and Science of Science Popularization were published afterwards. Some intended to construct the theoretical systems and practical patterns for modern science popularization based on the modern sociology, modern science of education and modern science of communication. Basic problems encountered in theoretical construction and development of science popularization were summarized, systematic process and main factors including backgrounds, purposes, undertakers, objects, contents, conveyers, effects were analyzed for modern science popularization.

All these books differed from each other mainly in the degree of influences they received from modern theories of public understanding of science and communication of science and technology due to different times. With no fundamental difference exists in their logics and arguments, they have the following points in common:

(1) They all try to string the practices and theories of science popularization together by a certain system, which reflects the cognition of researchers on the systematic and disciplinary characteristics of science popularization. The simple and plain understanding in the past has become multi-dimensional, leading to more complete and integral understanding of science popularization. However, the logics supporting the system are still vague, without enough analysis and links between science popularization and the nature of science as well as popularization practices and mechanisms. Thus, these systems looked somewhat like a cabinet with lots of things stored in it, instead of a big tree with stems and branches.

(2) As the inheritance and enhancement of the science popularization study in the second period, the study of science of science popularization in these books unavoidably has the feature of macroscopic and top-down standpoint. The attempt to fit science popularization into a systematic framework continued from 1978 to 21st century, but mainly from the vision of science popularization undertakers (government or related organizations) and considered the science of science popularization “a science to study the rules of relay, popularization and pass-on of knowledge and

techniques”. Even some analysis and researches went deeply into certain aspects of science popularization practice, the theoretical study in these articles could not surpass the preset boundaries due to limited standpoints.

(3) With the emphasis on absorption from Communication Science, these books were somewhat superficial in “copying” the theories of communication. Although these studies made great improvement to previous achievements, nevertheless they were of constrained vision and depth. Such science communication studies in the form of “simple combination of science communication concepts with the theory” can easily be observed in many research papers.

Reflections on and inceptions in traditional science popularization ideas

After the introduction of public understanding of science into China, some scholars considered that “science communication” should be used instead of “science popularization” because the former has a broader vision and more profound contents as compared to the latter, and fits better with the nature of science popularization at new times. There’s also another consideration saying it is not necessary to go to the extremity of completely replacing “science popularization” by “science communication” because selection of terms is less important provided that new ideas and thoughts can be included in the term being used. Lots of things could be done by expanding the original concept even under the same term. In fact, these considerations reflect that the concept embedded in the term “science popularization” has had constraints on its application, therefore new ideas should be added to it. The following three points explicitly summarizes the new ideas: (1) Science popularization should develop from one-way popularization to two-way interaction. On the one hand, scientists deliver scientific knowledge to non-specialists; on the other hand, the public participate in the creation of science, the formulation of science policies and the construction of scientific systems, and interpreting the role of science in the society together with scientists. (2) Science communication is not only a measure applied by the scientific community to reach their purpose, nor a unilateral one-way activity of the nation, but the figuration and construction of culture. (3) The science communication process is a process of convergence of science and humanities.

The proposition of rename is opposed by some other scholars for different reasons. Some take science communication as a concept with broad contents including not only science popularization and scientific news, others find that science popularization emphasizes result while the science communication emphasizes process, thus they could not replace each other since they are not equal logistically. These debates showed different understanding on the contents, purposes and positions of science popularization, and brought new contents to the concept of science popularization as time passed by.

After looking into different definitions of science popularization these years, we found that the contents of science popularization are basically four scientific things, i.e., scientific knowledge, scientific methods, scientific thoughts and scientific spirits. (In fact, science popularization in China for all these years put much more emphasis on popularization of scientific knowledge than the latter three.) The way of science popularization is referred more to communication but without detailed explanation (which reflects our weakness in science communication study). The target audience has always been the public, while the purposes are enhancement of economy and culture by improvements of individual’s scientific literacy. Though there lack some description of the main body of science popularization, transformation from government guidance to public participation and interaction could possibly be noticed. Big changes are the emphasis on understanding of the relations between science and society, and the requirements on public abilities to participate in public scientific affairs which showed science, society and individuals have gradually become the important subjects in science popularization studies.

In fact, there existed for a long time the debates on science popularization and science communication, which gradually lead to analyses on stages of science popularization and arguments on their models and standpoints. Professor Liu Huajie from Peking University pointed out two traditions in science communication in China: (1) science popularization; (2) science journalism. Followed the first tradition, there are three stages in science popularization: traditional science popularization, public understanding of science and science communication. Their communicative models and standpoints are shown in the table below.

Table 1. Models & standpoints of public communication of science

	Models	Standpoints
Traditional science popularization	Central broadcasting	Of Nation (or Party)
Public understanding of science	Deficit model	Of Scientific community
Reflective science communication	dialogue (or participation)	Of citizen (or humanism)
Trends	with feedback and participation	Multiple coexistence

According to Liu Huajie, the 1st model was used in planned economy times for the needs of nation and governments. It emphasized on academic authorities and scientific beliefs, paid more attention to knowledge and techniques, but less to scientific methods and processes, say nothing of social operations, limitations of science and faults of scientists. The science popularization perceptions in this model derived from the mainstream ideology and combined the science popularization practice with the need of production and construction, which resulted in a unified mechanism of science popularization under centralism. The second model is science popularization or communication with preset scientific authority and ignorance of the public. And the science popularization practice in this model targeted on the improvement of public scientific literacy as well as public support to scientific work. The third model is characterized by diversity of audience and main bodies, emphasis on public attitudes and right of expression, consideration of social justice and fair distribution, etc. In his opinion, the science communication ideas in China lie between first and second models, with a transition to the third model to some degree. The three stages and their models neither appear in sequence, nor grow upon in grades, but coexist at present with respective emphasis. The reality tells us science communication is a multi-dimensional concept in multi shapes.

The analyses of three-stage division of science popularization revealed the humanistic perspective of science communication study, answered the questions of what to communicate (first or second order/first and second order) and why communicate (people oriented), but lacked discussion on how to communicate.

The study on science communication mechanisms became important when the concept of science communication was accepted by more and more people and even brought about the expansion of the connotation of science popularization, but study in this field in China is limited to some analysis and researches on western theories.

In Models of Public Communication of Science in the Background of Communication Theory from Europe and America, the author concerns about the research of MPCs in Europe and America. He classifies theories about MPCs to three kinds, i.e. traditional models, alternation models and some new models in the background of media-isolation. Generally speaking, MPCs undergo a process from linear models to divergent models, and then to web models. There are many backgrounds and hypothesis in this process, which are worthy of studying. Traditional models (canonical account models and others) were put forward after the institutionalization of science. In these models, the “simplified” science knowledge is diffused to the public through the media, which is simple but of defects. The criticism comes from two ways: on one hand, psychology research proved that when the public learn about science, it’s a rather active than passive process; On the other hand, some scholars find out that the boundary between science and common sense is not as clear as the traditional models said. They think that science communication is not only a kind of communication but also a part of science, and PCS is the last process of the science communication. The relations between the media, science and the public become more and more complex with the development of media. John Durant’s model shows the interaction between media and the public. Web model by Bruce Lewenstein proves that the complexity of communication leads to the informational instability. In Peter Weingart’s opinion, science means intermedia, and the media has replaced the monopoly station of the science.

Except for the above mentioned dissertation, there are other articles giving deep and detailed analyses of models and theories of public understanding of science. There’s one paper exploring division of science communication models in terms of dissemination structure, called respectively vertical communication, diffused communication, hierarchical communication and feedback communication, etc. However, there is still short of studies on mechanisms coincide with actual situation and helpful for science popularization practice in China.

If we make a simplified summarization of the concerns of science popularization studies in this period (the real facts are much more complicated), we will concentrate on three aspects: the contents, purpose and mechanisms of communication. The communication contents (what to communicate) changed from mere “positive” scientific

knowledge, which was considered self-evident, to cognition of the importance of scientific methods, thoughts and spirits, as well as doubt on the authority of science. The communication purpose (communicate for what) changed from governmental needs to the proposition of public needs. And the communication mechanisms (how to communicate) emphasized on the exploration of functional communication models, with lack of study on effective mechanisms.

Studies on public scientific literacy

Followed and accompanying the attempts to construct theoretical systems for science popularization and the reflections on traditional science popularization, many researchers show their interest in study on the promotion of public scientific literacy aroused by the survey of public scientific literacy.

Around 1990's the study on public scientific literacy in China began with the introduction of the results and systems of the survey of public scientific literacy by Jon Miller. Then seven investigations were carried out respectively in year 1992, 1994, 1996, 2003, 2005 and 2007, with the eighth one going on now in the whole country. Originally the surveys were done applying the whole set of measuring tools of Miller's from the basic theory to the methods.

After years of development, we have had our own thoughts and studies at the theoretical level based on our learning from the surveys and absorption of advanced theories of public understanding of science. These studies include both applied research directly related to and theoretical research indirectly related to the survey. For the former there are studies on the index of public scientific literacy, sampling, and weighted calculation, etc., for the latter there are analyses on concept and contents of public scientific literacy and studies on related communication theories. For example, in the doctoral dissertation *Research on Theory & Practice of Measurement of Public Scientific Literacy: Take Miller's System as a Clue*, Li Honglin establishes an analytic framework to carry out a comprehensive inquiry to theories and practices of the measurement of public scientific literacy based on multidisciplinary research perspectives and a wide range of critical attitudes of STS.

It is explained in the paper why the cognition of scientific literacy and the measurement design of Miller's system deeply reflect the implicitly underlying traditional view of science and the "deficit model" of public understanding of science, as well as how multiple models (e.g. democratic model, reflective model) and concepts

(e.g. three paradigms of PUS, civic epistemology) of PUS reflect on the theoretical foundation of Miller's system and contribute to the theoretical evolution of the measurement of public scientific literacy. It is commendable that a stratified measurement structure that combines both "living science" (a new concept suggesting the importance be attached to the combination of living science, academic science and post-academic science) and Miller's system should be adopted in the measurement of Chinese public scientific literacy. No matter better or worse in rationality and feasibility of this structure, the exploring approach and studying vision of relations between public scientific literacy measurement and theoretical models are of value.

Around the issue of Law of the People's Republic of China on Popularization of Science and Technology in 2002 and Outline of the National Scheme for Scientific Literacy (2006-2010-2010) in 2006, some studying projects have been launched in order to provide theoretical basis and practical foundations for their formulation as well as further explanations for future implementation.

An example is the Research Analects of National Scheme for Scientific Literacy collecting 21 research reports by 11 teams around the formulation of the National Scheme. The research contents of these studies include: the connotation, structure and situation of public scientific literacy in China, factors influencing the public scientific literacy in China, the purpose and importance of promoting public scientific literacy, ways, mechanisms and environments for the enhancement of public scientific literacy, national standards of scientific literacy for Chinese public, the monitoring and assessment of projects aiming at promoting the public scientific literacy. The achievements of all these studies had their reflections in the guidance and plan of the Outline on the construction of public scientific literacy in China. For example, the public scientific literacy is expressed in the Outline as "knowing some necessary knowledge of science and technology, mastering basic methods of science, building up science thoughts, advocating science ethos and having the ability to apply them to resolve practical problems and participate in public affairs". This is summarized and refined from two reports in the Research Analects of National Scheme for Scientific Literacy. So are the purposes in each implementation stage, the schemes for different groups of people, and the setup of basic science popularization projects.

A large proportion of studies on public scientific literacy are applied research, e.g., the index study in survey of public scientific literacy, and the reliance of the Outline on theoretical study achievements. However, many studies still remain at superficial level dealing with empirical research on science popularization practice. Reasons hidden behind the problems haven't been figured out nor effective resolutions been proposed. For example, though recognized by

some researchers, there are no detailed patterns, ways or measures given for the rules of “multi-participation, two-way interaction and alternate integration” which should be obeyed in the promotion of public scientific literacy.

Conclusions

The characteristics of science popularization studies in China are figured out by combing its theoretical development and analyses of typical issues. The features are summarized as follows:

- (1) Science popularization studies in China is undergoing the period of accumulation and integration of theories. But the advancement develops slowly possibly due to the lack of an flexible and open system and advanced research methods.
- (2) The multi-disciplinary interaction in science popularization or science communication studies is very obvious. Influences on the theoretical study of science popularization in China mainly come from public understanding of science and science of communication.
- (3) There are lots of macro level studies while lacking micro level ones.
- (4) Equal emphases are paid to theoretical and practical studies, but there's not many in-depth and detailed case study.
- (5) The influence of traditional science popularization study patterns result in much more studies from point of view of the main body than those from the angle of target audience.
- (6) The study on science popularization mechanisms need to be strengthened.