Empirical Study on Libraries' Dissemination of Scientific Culture Through New Media: A Case Study of "Science Talks" at the National Science Library, Chinese Academy of Sciences (Postprint)

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Abstract

[目的/意义] Taking the orderly advancement of the "Scientist Forum" in the domain of "new media + science culture content" as the primary case study, this paper expounds on the specific applications of new media technology in science culture dissemination activities in libraries, and identifies the advantages and developmental directions of science culture communication work in professional libraries.

[方法/过程] By systematically reviewing the lecture content, distribution channels, and viewing data of the "Scientist Forum", this study employs data analysis to investigate the main factors influencing the effectiveness of science culture communication.

[结果/结论] The characteristics of new media—including timeliness, flexibility, and strong interactivity—have demonstrated significant effectiveness in science culture communication. The integration of libraries' service orientation, rich collections, and scientific humanistic spirit with the technological advantages of new media has substantially enhanced public engagement interest, bridged the gap between science and the public, and improved the overall effectiveness of science culture communication.

Full Text

A Study on the Practice of Libraries Using New Media to Disseminate Science Culture: A Case Study of the "Science Fellow Forum" at the National Science Library, Chinese Academy of Sciences

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Abstract: [Purpose/Significance] Taking the orderly advancement of the "Science Fellow Forum" in terms of "new media + science culture content" as the main case study, this paper discusses the specific applications of new media technologies in library-led science and culture communication activities, aiming to identify the advantages and development directions of professional libraries in science culture communication work. [Method/Process] The paper sorts out the lecture content, dissemination channels, and viewership data of the "Science Fellow Forum," analyzing the main factors influencing the effectiveness of science culture communication through data analysis. [Result/Conclusion] The characteristics of new media—timeliness, flexibility, and strong interactivity—have achieved good results in science culture communication work. The combination of libraries' service consciousness, rich collections, and scientific humanistic spirit with the technical advantages of new media has greatly enhanced public interest in participation, shortened the distance between science and the public, and improved the effectiveness of science culture communication.

Keywords: new media; library; science; culture communication

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1. New Media Needs in Library Science Culture Activities

1.1 Research Background According to the 46th "Statistical Report on China's Internet Development" released in 2020, by March 2020, China's internet user base had reached 903 million, with an internet penetration rate of 64.5%, among which mobile internet users numbered 897 million [1]. As traditional media gradually fade from the sight of younger generations, mobile devices and social media are continuously integrated into the science culture communication process. Against this backdrop, the science culture communication work of the National Science Library, Chinese Academy of Sciences, has gradually established a science culture communication matrix for the public, using social software such as WeChat, Weibo, and Douyin as channels, major achievements of the Chinese Academy of Sciences as content, and the National Science Library as its base. This process represents self-innovation by science culture communication workers adapting to technological iteration.

As early as 2016, President Xi Jinping emphasized at the National Conference

on Science and Technology Innovation the need to strengthen science popularization education and foster a good social atmosphere of "talking about science, loving science, learning science, and using science" [2]. The key points of the Fifth Plenary Session of the 19th CPC Central Committee proposed that "by 2035, the quality of citizens and the degree of social civilization will reach new heights, and the country's cultural soft power will be significantly enhanced" [3]. In September 2020, the General Office of the CPC Central Committee and the State Council issued the "Opinions on Accelerating the In-depth Integrated Development of Media," pointing out the need to optimize resource allocation with internet thinking, channel more high-quality content, advanced technology, professional talent, and project funds to the main internet battlefield and toward mobile terminals, enabling scattered offline forces to quickly move online and go deep into the internet, to build and strengthen online platforms, and to occupy emerging communication positions [4].

In this context, libraries have the obligation and responsibility to participate in science culture activities that guide the public to master scientific knowledge and popularize the spirit of science culture [5]. In this process, librarians have the responsibility to broaden communication channels and attract public participation in library cultural communication activities. As American librarian Shera said, "The task of librarians is not only to ensure that the library's doors are always open, but also to make those doors attractive" [6]. The use of new media is essentially a communication means to attract public participation. In the "Internet +" digital context, various libraries have carried out science culture communication activities through multiple new media channels such as mobile phone libraries, official Weibo accounts, and digital TV libraries [7]. Library cultural communication activities should not merely use new media tools superficially but need to align with the characteristics of new media tools to reintegrate the content and forms of library cultural output.

How can libraries combine their collection advantages to channel excellent resources toward the internet and provide science culture services for the public? Under the pressure of resource competition as research institutes, science and technology museums, and museums join science culture communication work, libraries also face the dilemma of being marginalized in public demand. In this internal and external predicament, librarians need to explore new service models, discover new resources, and provide new types of services. Users no longer borrow paper books from libraries to read page by page but directly receive digital cultural products refined and promoted by libraries. In the torrent where science culture communication work has become a universal trend, librarians should find their accurate positioning according to professional characteristics and give play to their professional advantages. To sum up, in library-based science culture communication activities, the core significance of professional libraries and the functional positioning of librarians need to be reconsidered.

1.2 Definition and Development of Science Culture Communication

The concept of "science communication" was first proposed by British sociologist of science Bernal: "From the perspective of the whole society and nation, only a society that can understand and accept science can obtain the benefits of science" [8]. In the late 1980s, China introduced the concept of "public understanding of science" from the Royal Society of the UK, which can be regarded as the prototype of domestic science culture communication theory. After 2000, scholars such as Liu Huajie and Wu Guosheng proposed a new and more inclusive concept and named it science communication [9]. "Science communication" has three conceptual characteristics: first, the process has moved from one-way dissemination in science popularization to two-way interaction; second, science communication activities are a form of cultural construction; third, science communication is a process of interaction and integration between science and humanities [10].

Broadly defined, science communication includes science popularization, public understanding of science, and all activities related to science communication and popularization, ultimately aiming to improve the scientific literacy of all citizens. Narrowly defined, science communication specifically refers to science communication as a stage or model within the broader sense [11]. This paper adopts the broad definition of science communication and no longer makes semantic distinctions between science popularization and science culture communication.

As science culture communication activities gradually change from one-way to two-way interactive processes, the "public understanding of science" model is gradually replaced by the "public participation in science" model that embodies democratic spirit. This model emphasizes equal dialogue between scientists and the public, respects the value of ordinary people's non-professional knowledge, and obligates the scientific community to facilitate public participation in scientific affairs [12]. Domestic scholars believe that "science communication" uses the communication concept of "pluralism, equality, openness, and interaction" to understand and treat science. Therefore, the public needs a more open and communicative environment to have a voice and corresponding discourse power in interaction [13]. Against this backdrop, the open and communicative characteristics of new media can accurately play an advantageous role. Consequently, research on the traditional issue of "the relationship between science and media" in the field of science communication is continuously deepening. Compared with traditional media, social media has received more attention from science communication scholars.

However, multiple studies have found that on social media, official institutions basically only release information one-way and rarely communicate and interact with users [14]. In summary, the widespread popularity of new media has broken the original pattern of science communication and presented characteristics such as diversified subjects, diversified content, and active audiences, bringing new development opportunities for science communication [11].

Under fixed communication subjects, besides maintaining high-level content out-

put, how can libraries make the public feel the sense of equal interaction in science culture communication activities? How can they actively mobilize public participation through new media channels? These are new problems faced by librarians in library science culture communication work.

1.3 Forms of Science Culture Communication

1.3.1 Offline Mode In recent years, science culture communication forms have gradually diversified. In addition to library reading promotion activities, science and technology museums and museums have also participated in science culture communication work. For example, the "Magnetic Levitation Experiment" at the China Science and Technology Museum uses direct demonstration-type communication, enabling audiences to obtain intuitive scientific experience by observing experimental phenomena. The "Stories of Indigenous People" at the Burke Museum in Australia uses storytelling to integrate scientific and historical knowledge. Competitive science popularization activities such as the "Ball Rolling Competition" at Zhengzhou Science and Technology Museum not only enable the public to understand the scientific knowledge contained in exhibits during the competition process but also greatly enhance public participation enthusiasm [16]. However, domestic theoretical research on library science popularization reading promotion services or activities is still scarce, remaining at the stage of concept definition and case summary, with relatively few relevant theoretical achievements [17].

1.3.2 New Media Communication Methods Relative to traditional media, "new media" is a constantly changing and developing concept. At the technical level, the essential characteristic of "new media" should be digitalization. Digitalization and interactivity together constitute the essential characteristics of new media. From the perspective of current technology, the new media discussed in this paper mainly refers to social software such as Weibo and WeChat, and video platforms such as Douyin and Kuaishou.

In new media science culture communication activities, as early as around 2000, American museums used digital technology to create collection databases and museum education network resources [18]. Domestic digital collection data started relatively late, but in recent years, science and technology museums have begun to use new electronic sand tables and digital exhibits to enable audiences to observe exhibit details from various angles. For example, in 2018, the Shanghai Waterworks Science and Technology Museum launched a VR technology display, where the public can visit the virtual reality venue through the WeChat public account. VR technology enables the public to query, retrieve, and view the museum's scenes through an information platform, automatically obtain corresponding text introductions by downloading the venue APP, and receive digital services [19]. The above activities are typical models of science culture communication in the new media environment.

Domestic libraries have successively opened official accounts on new media platforms convenient for mobile browsing, completing their cultural promotion activities through channels such as Weibo, WeChat, and Douyin, establishing two-way interactive communication channels between libraries and the public, and transmitting the library's excellent books, precious ancient books, spiritual culture, and other content to the public. The public then feeds back their reading insights and demands to the library, which adjusts its communication content appropriately based on the feedback. In this cyclical promotion and communication, the public's reading interest and volume continue to increase [20].

A survey of new media tools used by some domestic libraries (see Figure 1 [Figure 1: see original paper]) found that in the new media environment, Weibo and WeChat clients are the two main positions in reading promotion activities.

Research on the application of new media tools by various libraries found that libraries have moved from centering on in-library services to centering on embedding in user processes. The role of libraries is no longer limited to what happens inside the library but shifts to what happens in the user's environment [21]. The effect of traditional event posters has been greatly weakened. As social information dissemination media, Weibo and WeChat public accounts serve as channels for releasing activity notices, previews, and library news, enabling the public to receive information quickly.

In addition to offline event promotion, libraries also use new media software for online reading promotion activities. Leveraging the technical advantages of new media software that can quickly and massively disseminate pictures, audio, video, and other content, reading promotion activities are no longer limited to boring text-based promotion, and forms have become diverse and interesting. Some libraries have launched emerging educational reading methods such as micro-reading and listening under their official public accounts. This fragmented reading method better fits the current public's reading habits. By transforming paper books into audio and video through this new reading form, knowledge is transformed into a "communication method of language exchange," greatly broadening the channels of cultural communication [22]. For example, in reading promotion activities, the National Library of China launched on Weibo—National Library Foreign Literature Promotion "Daily Journal," National Library Foreign Literature Promotion "Today in History," and other interesting activities combining pictures and text. There are also daily routine planning topics such as "Daily Classic Recitation · National Library Says Good Morning" and "Daily Classic Recitation · National Library Says Good Night." These activities stably output cultural resources to the public for a long time. In terms of audio and video, the "Wenjin Classic Recitation" and "Wenjin Reading Salon" and other digital network audio and video resources launched by the National Library; the Capital Library launched the "Capital Library Forum—Cloud Classroom Recommended New Books Activity." These resources on new media platforms have become readers' second pair of eyes for reading.

In addition, some enterprises cooperate with libraries using new media channels for marketing promotion and publicity. They use the high-quality content provided by libraries to establish brand images and obtain profits, while libraries use the traffic of enterprises to promote their own brand activities, thereby achieving a win-win cooperation goal. For example, Shandong Provincial Library cooperated with Ximalaya in WeChat programs to conduct online electronic micro-reading promotion activities.

Various libraries upload collection content and audio-visual materials of lecture activities to network resource platforms, using new media clients as access ports to open to the public. Among many cultural promotion activities, the lecture model that can organically combine online and offline activities has been favored by various libraries. Overall, new media network platforms in library cultural promotion activities have transformed from a single notification platform to an integrated storage and service platform that publicizes library collections and disseminates knowledge and culture to the public. The "China Science News" client of the National Science Library, Chinese Academy of Sciences, is a typical representative of this service model.

3. Case Study of the "Science Fellow Forum" at the National Science Library, Chinese Academy of Sciences

The National Science Library, Chinese Academy of Sciences, based on the Chinese Academy of Sciences, uses new media accounts "China Science News" and "Zhongke Zhihui" in cultural communication. Functionally, it fulfills reading and cultural activity promotion while also leveraging the characteristic advantages of a professional library. With the purpose of scientific knowledge dissemination, scientific spirit inheritance, and scientific ideal inspiration, it carries out training on scientific and technological information, literature retrieval, and scientific research paper writing for staff within the Chinese Academy of Sciences. For the public, it pushes characteristic collection features and the Science Fellow Forum. The above pushes include scientific and technological information and frontier conference reports with strong professionalism, and the audience is mostly the scientific community. Science popularization activities represented by the "Science Fellow Forum" have a larger target audience and serve as a good model for studying the impact of changes in communication channels on the effectiveness of science culture communication.

3.1 Background and Characteristics of the "Science Fellow Forum"

The "Science Fellow Forum" is a public welfare lecture brand hosted by the Beijing Branch of the Chinese Academy of Sciences and the National Science Library, Chinese Academy of Sciences. Founded in 2008, it has effectively integrated multi-party resources by combining with the construction of the Innovation Culture Square of the Beijing Branch and science culture communication activities of various institutes in the Beijing area, having held nearly a thousand special science popularization lectures to date. As an institution affiliated with

the Chinese Academy of Sciences, the lecture guests invited by the National Science Library mostly come from various institutes in the Beijing area of the Chinese Academy of Sciences and universities in Beijing, striving to ensure that the output of science culture retains the value propositions and authority of the scientists themselves. While ensuring scientificity and combining the characteristics of library collections, it adopts a form combining lectures with recommended books. The most representative feature is the "Science Culture Series Book Sharing Fair" series of activities, where lecture guests share good books on science culture and lead the audience to read them together. For example, the lecture "Evidence: A 90-Year Fossil Legend" by researcher Wang Yuan, curator of the China Paleozoological Museum, who is also the main author of the popular science work "Evidence: A 90-Year Fossil Legend." Scientific promotion by the author himself achieved better reading promotion effects.

3.2 Communication Effects Across Platforms Since its inception, the "Science Fellow Forum" has tried various media communication forms. In 2008, Nobel Prize winner in Physics Mr. Yang Zhenning gave the inaugural lecture titled "The Fascination of Physics" for the "Science Fellow Forum." In the era of print media, to expand influence, lectures cooperated with newspapers and magazines such as *Science Times* (renamed *China Science Daily* in 2012) and *Beijing Science and Technology Life*, which published activity reports after the lectures. Attempts under the new media service model are mainly divided into three development stages: portal websites—WeChat public accounts—Weibo live streaming. The early websites mainly targeted visitors to the National Science Library website. Activity previews were released on public accounts such as "Zhongke Zhihui" and "China Science News," with the main audience being interested people who had participated in National Science Library activities and followed the institution's public accounts.

3.2.1 Web Page Communication Form In 2012, the National Science Library opened a science culture communication service platform. By visiting the library's service homepage (http://www.las.ac.cn), users can enter the science culture communication service platform. The "Online Lecture Hall" column allows browsing of all lecture themes, encouraging the public who did not attend the lectures to watch science popularization videos online. The average daily playback volume of the PC-side "Science Culture Communication Platform" webpage is around several hundred. "How Are High-Speed Trains Designed?" once achieved up to 14,000 online clicks, with this peak occurring around 2011.

With the gradual weakening of traditional print media's communication power, the "Science Fellow Forum" has gradually developed toward an online service model. Lecture notifications and activity announcements released by *Science Times* have changed to regular activity previews published on the science culture communication platform page. After the event, librarians refine and organize the lecture content into short articles and publish them on the science culture communication platform web page.

3.2.2 New Media Communication Effects With the advancement of new media technology, the work team tried to use WeChat publicity to cooperate with offline lecture promotion. When the 2020 COVID-19 pandemic made offline activities impossible, the "Science Fellow Forum" turned again to a fully online live broadcast model of "WeChat + Weibo live streaming." The second peak of online viewership of "Science Fellow Forum" lecture videos appeared on the Sina Weibo live broadcast platform in 2020. Among the 22 "Science Fellow Forum" live broadcast activities held from March to September 2020, seven lectures had more than 10,000 viewers, with an average of about 3,000 viewers per lecture. After promotion through well-known mobile news clients such as "Tencent News" and "Baidu APP," lecture clicks increased significantly in the second half of 2020, with an average of nearly 300,000 views per lecture across the entire network. Through models such as Sina live broadcast and network news client access, the communication effect of the "Science Fellow Forum" has achieved obvious quantitative improvement.

3.3 Factors Influencing New Media Communication Effects The 2020 Weibo playback data of the "Science Fellow Forum" is as follows (see Table 1). In addition to objective factors such as lecture titles, guest popularity, and content accessibility, through various attempts such as expanding online live broadcast platforms, adding content topics, and adding interactive activities, the effect of science culture communication has been significantly improved.

3.3.1 Impact of Platform Selection The data clearly shows that the expansion of lecture publishing platforms is the main factor for the growth in content readership. Social platforms such as Weibo and WeChat have significantly better communication effects than traditional PC-side science culture communication websites. In terms of social platform selection, for the same lecture content, the average readership on WeChat public accounts is about 200, while the average readership on Weibo can reach 3,000 per lecture. This shows that Weibo, which aggregates mainly by interest, is more suitable for science culture communication work than WeChat, which is based on 熟人 links. After July 2020, the "Science Fellow Forum" cooperated with "Science and China - Cloud Lecture Hall," expanding communication channels on the basis of the original live broadcast port, introducing simultaneous live broadcasts on multiple video website ports such as "Guokai Hui Learning," "Tencent News," "Tingting FM," and "Yangshipin." In terms of data, the total number of participants is about double the data from a single platform. The multi-platform model can greatly increase the number of viewers of science culture communication and improve communication effects, as shown in Table 2 .

3.3.2 Positive Impact of Network Clustering Network clustering is a phenomenon where netizens spontaneously gather in a certain online public domain to express themselves through posting or replying, which is a special communication phenomenon of spontaneous gathering in virtual space [23]. In Weibo

communication, the spontaneous communication method of network clustering may bring new breakthroughs to science culture communication work. For example, for academician Zhong Kang's lecture "From Nature to the Dining Table: The Magic of Domestication," the topic tag "# 全民素养提升 V 计划 #" was added. By the article's deadline, this topic had accumulated 26.145 million online readings, greatly enhancing the dissemination of the published video.

3.3.3 Positive Impact of Interactive Links Taking academician Zhong Kang's lecture "From Nature to the Dining Table: The Magic of Domestication" as an example, the background system can count the number of participants in the quiz (see Table 3). Statistics show that the activity lasted 6 days, with a total of 18,003 registrations, 17,462 participants, 62,974 quiz attempts, an average accuracy rate of 81.14%, a maximum question accuracy rate of 94.44%, and a minimum of 61.28%. The work team can also analyze the distribution of audience interest points based on these intuitive data to better adjust lecture content planning and interactive difficulty in the future.

Embedding interesting links such as prize quizzes in the information release process can significantly increase the readership of activity previews. The new media company cooperating with the "Science Fellow Forum" implanted vivid quiz games in the WeChat public account and Weibo interface. Each participant has 10 quiz opportunities per day, with 3 questions per level. Only by answering all questions correctly can they enter the next level. If they answer incorrectly, they can continue to answer until they use up all their chances. Participants can unlock a level and participate in a lottery draw for each level unlocked, with prizes being academician works and scientist spirit cultural and creative products. This process is educational and entertaining, improving public participation enthusiasm and significantly increasing readership. Table 3 shows the data of the fun quiz activity for academician Zhong Kang's lecture.

3.4 Utilization of New Media Characteristics

3.4.1 Timeliness Using new media, professional libraries can respond quickly during emergencies, conduct emergency science culture communication, and effectively transmit emergency management knowledge and capabilities to the public. In 2020, under the emergency of the novel coronavirus pneumonia epidemic, the public showed unprecedented attention and cognitive demand for knowledge about viruses and mental health. The National Science Library, together with the Academic Divisions of the Chinese Academy of Sciences, the Open University of China, and other units, jointly launched the "Scientific Understanding of Disease and Health" series of themed "Cloud Lectures," jointly undertaking the social responsibility of science popularization work and presenting accurate knowledge about the novel coronavirus to the audience. For example, against the background of gradual resumption of work during the epidemic this year, to avoid panic among the public, academicians such as Lu Lin

from Peking University Sixth Hospital, researcher Liu Zhengkui from the Institute of Psychology of the Chinese Academy of Sciences, and researcher Yang Qiuli from the China Academy of Chinese Medical Sciences were invited to give a series of online lectures on mental health during the epidemic, achieving good forwarding and diffusion effects.

3.4.2 Flexibility From the perspective of expert invitation, traditional offline lecture guests were mainly scientists from the Beijing area. The recorded format of online lectures avoids the trouble of long-distance travel, making scientists from outside Beijing more willing to participate. For example, Professor Li Miao from Southern University of Science and Technology in Shenzhen was invited to give an online lecture "Talking to Children About Extraterrestrial Civilization," and Sun Hailu, project leader of the "Life Cycle Table" from BGI, was invited to participate, using individual traffic to feed back science popularization traffic. In terms of lecture duration, the 60-minute science popularization lecture contains the scientist's internal logical thinking and is temporarily not suitable for short video dissemination formats like Douyin. However, in the long run, fragmented short video dissemination is more conducive to the public's rapid acceptance of scientific knowledge. In future communication planning, the National Science Library considers drawing on the push format of short video platforms, extracting the essence of scientists' lecture videos, and pushing them in the form of small videos to attract more audiences to watch the full content on the official website.

From the perspective of audience residence, traditional offline lecture audiences were limited to the vicinity of the National Science Library, while online lectures radiated the audience group nationwide, with a significant increase in audience numbers, expanding the breadth of science culture communication services in space. The National Science Library annually records the "Science Fellow Forum" activity videos of the year onto CDs for preservation, and the Open University of China officially publishes some content, forming science popularization publications, which further extends the time dimension of science culture communication.

3.4.3 Interactivity In offline activities of the "Science Fellow Forum," interaction between the audience and guests is limited to post-lecture discussions, which is point-to-point communication. Social network services, with their interactivity and user relationship-centered service model, have changed the operation mechanism of information dissemination [24]. Weibo's real-time comments and bullet screen functions achieve synchronous interaction between online and offline, transforming linear interaction into higher-participation network interaction.

In contrast to the "elite culture" inherent to scientists, new media communication shapes "civilian culture" in society. Conducting lottery activities on new media platforms attracts audiences to participate in online quizzes and interac-

tions. Activity gifts are usually popular science books related to the lectures and cultural and creative products promoting the spirit of scientists, jointly forming a virtuous cycle of "science popularization lecture—popular science book recommendation." In addition, the website background has clear data records for each lecture. By reviewing the number of online listeners for different lectures and analyzing the audience's preferences for the genre and expression methods of science popularization lectures through clear quantitative analysis, it helps form a good feedback mechanism.

3.5 Current Status and Development Plans The National Science Library is gradually building an integrated online and offline mainstream communication pattern, organically combining regular activities with new media to better complete science culture communication work. The library still takes providing excellent scientific knowledge and major achievement lectures as its foundation, establishing an all-media communication system supported by advanced new media technology, telling good stories about scientists, and spreading science culture.

Adapting to the major trend of "Internet + new media" integrated development, the "Science Fellow Forum" of the National Science Library, Chinese Academy of Sciences, has gone through three stages: newspaper, webpage, and WeChat channel publicity combined with offline lectures, transforming into a lecture format combining WeChat and Weibo publicity with online live broadcasting. From WeChat communication platforms based on 熟人 communities to live broadcast platforms aggregated by interest, the community spectrum targeted by science culture communication is continuously broadening. How to build the brand impression of the "Science Fellow Forum" to make it stand out among similar science popularization works is the challenge we face next.

4. Case Reflection

With the rapid development of online information, library borrowing services are gradually being marginalized by society. The scale of library collections will also quickly lose its importance [25]. When digital collection resources gradually become the mainstream trend, libraries should also turn to seek new living space in the vast internet world. Libraries digitize their collection knowledge and conduct network promotion on this basis, which is the future trend of documentation services. In digital library activities, the role of librarians transforms into a complex intermediary service, whose work content contains multiple requirements such as user needs, service models, and knowledge content screening. Librarians can apply the old advantages of library services such as service consciousness, rich collections, and humanistic spirit to new media platforms, finding the unique advantages of library science culture communication work in the combination of traditional advantages and technology.

4.1 User Service Consciousness Advantage Whether in traditional in-library services or online services in the new media environment, the foundation of libraries has always been to provide high-quality service activities that meet user needs. The integration and classification functions of libraries can greatly help users smoothly find the materials they need. The work of librarians is shifting from book classification in the past to the screening, classification, and recommendation of network resources.

Compared with specialized lectures from universities and research institutes, lectures organized by libraries can leverage the comprehensive advantages of integration. They can integrate scattered science popularization lectures from research institutes into series of lectures. The "Anti-epidemic Mental Health Series Online Lectures" during the epidemic achieved good communication effects and social response. Another example is the "Science Fellow Forum" plan to hold a series of lectures on major achievements under the "Pioneer Action" plan of the Chinese Academy of Sciences, where librarians contact excellent science popularization lecture guests from various research institutes and scientific researchers undertaking major achievement tasks to produce a continuous lecture product promoting scientific and technological frontiers, uniformly pushed to the public. The public can avoid the trouble of searching for science popularization lectures everywhere on the internet and find all content under one theme from a centralized entrance.

4.2 Library Collection Advantage Under the policy orientation of vigorously promoting science culture communication work and the support of new media technology development, universities, research institutes, science and technology museums, and other institutions have all made contributions in science culture communication activities. Science and technology museums have venue and exhibit advantages, achieving good interactive effects with the public in science culture communication activities with strong participation and interest, which is an advantage that research institutes and libraries cannot match. However, in the new media context, this strong venue-adhesion advantage has become a constraint. Compared with the high technical requirements for VR digitization of physical exhibits, library collections are more suitable for digital new media operation models. New media can flexibly meet the public's demand for different types of knowledge through various new reading forms such as picture-text combination, audio books, and abstract push.

The rich collection content of libraries can flexibly respond to the public's demand for different types of knowledge. In addition to regular book promotion activities, through the message function of social media accounts, libraries can establish a good interactive feedback mechanism with users. The good interactivity of online communities can just meet the needs of surveying public knowledge demands, enabling timely mobilization of collection resources and rapid response to current hot topics. Compared with the mixed and unverified reprinted articles on the internet, content relying on publications undoubtedly

has more authority and is more trustworthy to the public. For example, the lecture "Medical Benevolence, Courageous Fearlessness—Rereading Wu Lien-Teh" launched during the epidemic, based on the collection "Plague Fighter: The Autobiography of Wu Lien-Teh," not only popularized anti-epidemic knowledge and stabilized public emotions but also recommended this excellent scientific biography to the public.

4.3 Spiritual Culture Construction Advantage In 2013, the U.S. "Next Generation Science Education Standards" proposed the educational concept of "interdisciplinary inquiry-based learning based on science and engineering practice," including scientific methods, scientific thinking, and scientific spirit applicable to various disciplines, social life, and personal development [16]. In China, President Xi Jinping pointed out at the symposium with scientists the need to focus on cultivating students' innovative consciousness and innovative ability. The spirit of scientists is a precious spiritual wealth accumulated by scientific and technological workers in long-term scientific practice. The majority of scientific and technological workers should inherit and carry forward the excellent qualities of older generation scientists who serve the motherland and the people [26]. Innovative quality education and scientific spirit publicity have become the top priorities in science culture communication work.

Compared with professional scientists, librarians should have more humanistic care literacy. Compared with public libraries, the National Science Library, Chinese Academy of Sciences, relying on the professional background of the Academy, has its own natural advantages in scientific research methods and scientist stories.

In terms of innovative quality education, in 2019, the first "Summer Youth Scientific Information Literacy Training Camp—Science Library: Revealing 'Spaceflight' " was successfully held at the National Science Library, Chinese Academy of Sciences, which was an offline science culture communication activity with good communication effects. In the future, with the support of new media and the good interactivity of online communities, librarians can complete scientific information literacy training lectures online. Young people can also flexibly choose scattered time to conveniently participate in library lecture courses. In terms of spiritual culture construction, the lecture "Please Let History Remember Them—The Enlightenment Brought to Us by the Development of 'Two Bombs, One Satellite' " given by He Lin, secretary of the Party Committee of the center, embeds scientific spirit in vivid small stories. Its online click rate is much higher than that of obscure scientific knowledge lectures, providing a good learning model for future science spirit popularization lectures.

Through the orderly advancement of "new media + science culture content," we can assist the digital transformation of science culture communication. Using the timeliness and flexibility characteristics of new media communication to improve the effect of science culture communication. In emergencies such as the epidemic, with the help of new media software, science popularization

workers can transmit accurate scientific knowledge to the public in the first time, dispel rumors, and stabilize public emotions. In addition, the interactive characteristics of new media allow the public to spontaneously participate in science culture communication activities and independently absorb science culture knowledge. The interactivity inherent in new media enables scientific content to sink to levels acceptable by all social strata, helping to shorten the distance between science and the public and enabling the public to better understand science culture. In the popular environment of new media social interaction, the enthusiasm of social software users for independent participation is continuously increasing. Using multimedia channels to disseminate science culture knowledge can mobilize user participation on a large scale, expand the scope of participating audiences, and serve as a new window for science culture communication activities.

In summary, combining libraries' original excellent service consciousness, rich collections, and scientific humanistic spirit with the timely, flexible, and interactive communication models of new media can mobilize public participation interest to a greater extent and expand the influence of science culture communication activities. In the long run, in terms of content, new media has characteristics such as massive storage, multimedia expression, and strong interactivity, but its original content still relies on the high-quality resources provided by libraries. In terms of form, judging from the rapid development momentum of new media, more communication media will participate in the cultural communication process in the future. Science popularization workers should timely follow up on new communication channels and continuously optimize communication forms. From the communication perspective, by improving feedback mechanisms and public opinion monitoring, more science popularization products that meet audience needs can be provided. Together, we can make due contributions to serving the scientific literacy of all citizens and improving youth science education.

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Yu Boya: Determined research ideas, wrote and revised the paper;
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Chen Zhaohui: Proposed the topic, improved research ideas, revised the paper.

Note: Figure translations are in progress. See original paper for figures.