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Research on Chinese Journalists' Scientific Literacy

*Xiao Juan Hu**

Department of Humanities and Social Sciences, Dalian University of Technology, Liaoning, China

Journalists are always on the "second battlefield" of fighting against COVID-19. In the face of major public health events, their scientific literacy is directly related to the effect of emergency science popularization. Based on related surveys and interview data in China, this article reviews the research on journalists' scientific literacy, clarifies the value of scientific literacy in journalism, and analyzes the cognition and practice of journalist scientific literacy. Through the analysis of cognition and practice, it explores feasible ways to effectively improve scientific literacy. The study found that journalist scientific literacy has a unique value in the crisis period, but the real measurement and self-cognition are not high. In the post-epidemic era, the social construction of science communication is stronger, and the media need to achieve a high degree of interaction with the scientific community to transform authoritative knowledge into popular science. Journalists should improve scientific literacy from their learning and professional training while using new media technology to scientifically demonstrate information.

Keywords: scientific literacy, journalist, science communication, COVID-19, China

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***Correspondence:**
Xiao Juan Hu
xiaojuan@dlut.edu.cn

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INTRODUCTION

At the beginning of 2019, the outbreak of the novel coronavirus pneumonia (COVID-19) profoundly affected our society and each individual. Faced with the crisis and panic, the public was eager for timely, accurate, authoritative, and scientific information, while various rumors, false information, and poor-quality information accompanying the epidemic were widely spread, causing a serious impact on public health and social stability. In the face of information overload caused by a mixture of true and false, how to meet people's information needs, provide timely channels of trust, and reliable guidance, "information epidemic" has tested the scientific literacy of journalists and the public.

When a major public health emergency occurs, journalist scientific literacy is directly related to the effectiveness of emergency science popularization. Mass media and professional media play an important role in providing authoritative scientific knowledge, interpreting epidemic prevention and control measures, as well as helping the public to correctly understand the development of the epidemic situation (Jie and Yanying, 2020).

Journalists have always been on the "second battlefield" of fighting against the epidemic, and their scientific literacy plays an important role in the management of epidemic information. How to transform professional scientific information into knowledge that the public can be familiar with and understand and how to present and disseminate it appropriately to reduce panic and rebuild trust reflect the unique value of journalist scientific literacy in times of crisis.

Scholar Lidan (2003) has two times discussed the misinterpretation of science by the media, indicating that one of the important reasons for the misinterpretation is the scientific literacy and rational thinking of the practitioners. Lidan (2003, p. 9) argued, "how to avoid over-hype news of little scientific value while finding appropriate news causes to spark interest in real scientific creations in respect of news values is a basic skill for journalists who report on science."

Scientific literacy is one of the proper requirements for professionalism in journalism, but it is not given the same attention in journalism and communication as indicators, such as journalistic ethics and business competence. It is usually because they do not understand science and do not conform to science that jokes are made, and errors are caused. We need true and scientific journalism, which needs a journalists' duty to accomplish.

RESEARCH DESIGN

Research Content

Through relevant investigations and interviews, combined with changes before and after the COVID-19 public health emergency, this article attempts to have an in-depth understanding of journalists' cognition and practice of scientific literacy to explore ways to effectively improve scientific literacy.

Research Methods

This study uses in-depth interviews and questionnaires.

The original data used in this article are from the "Science Literacy Survey of Journalists" carried out by the China Association for Science and Technology and The Institute of Science and Social Development of The Chinese Academy of Science and Technology from 2015 to 2017.

The research group sampled 16 news organizations from the Central Government, including TV stations, radio stations, news agencies, newspapers, and websites, as well as news organizations from 31 provinces to complete the questionnaire. A total of 4,170 personal effective questionnaires (852 at a central level, 2,116 at a provincial level, 740 at a prefecture-level, and 462 at a county level) were collected with an effective recovery rate of 81.6%.

Meanwhile, this article selects 25 practitioners from 7 media or media groups in four cities in Guangdong and Jiangsu provinces as in-depth interview subjects, and numbers them according to interview sequence. Thanks to the economic development and degree of openness and internationalization, the selected provinces and cities have formed a relatively developed media industry. Many influential media brands, especially Shenzhen, as a window of China's reform and opening up, have created the "Shenzhen Speed" that attracts worldwide attention. Shenzhen's scientific and technological level and scientific research and innovation ability are second to none in China. Shenzhen is one of the "top 10 cities in China with scientific research strength," as selected by *Nature* magazine.

LITERATURE REVIEW ON JOURNALISTS' SCIENTIFIC LITERACY

According to Web of Science search, there are 917 studies on scientific literacy, among which 67.94% are educational research, and only 4.04% are related to communication, with 37 articles. Most of them focus on the scientific literacy of the public or students, but there is little research on journalist scientific literacy. The attention paid to scientific literacy significantly increased after the financial crisis of 2008. International Journal of Science Education and the Journal of Research in Science Teaching were observed to be the top-cited and top publishing journals, respectively. However, no recent trend or emerging research direction has been noticed in the last decade (Yanyan and Mengmeng, 2021).

Research and Assessment of Civic Scientific Literacy

The term scientific literacy was first developed from the study of civic scientific literacy. Miller has been exploring and revising the three-dimensional model of citizen scientific literacy since 1983 when he published it publicly. Jon (1998) expressed it more comprehensively in his article "*The Measurement of Scientific Literacy*," which became a widely used knowledge method named the science, technology, and society model.

Some scholars systematically summarized the relevant indicators for measuring scientific literacy, such as the Program for International Student Assessment (PISA) science quality indicator system of the Organization for Economic Cooperation and Development (OECD)'s PISA, which includes competencies, knowledge, and attitudes (Chuanjie and Shukun, 2009). Here, competence is the result of the combined effect of knowledge and attitude in a certain context, the situational-knowledge-competence-attitude model. The index system for measuring the scientific literacy of Chinese citizens is developed from three aspects: scientific knowledge, awareness, and ability.

The research and assessment of civic scientific literacy started early and are relatively mature in China. The Chinese Association for Science and Technology (CAST) has conducted 10 nationwide surveys of basic civic scientific literacy since 1990. According to the 10th Chinese civic literacy survey, the proportion of Chinese citizens with scientific quality reached 8.47% in 2018. The results of the 11th Chinese civic scientific literacy survey are still being counted in 2020. Although the proportion has increased compared to previous surveys, it is still lower than the United States, 10% in 2008, and far from countries, such as Canada at 42% (2014) and Sweden at 35% (2005) (Liu et al., 2018).

Scientific literacy assessment in other industries is also gradually carried out. In the National Science Literacy 2049 Action Plan, the scope of science popularization is extended to young people, employees of enterprises and institutions, intellectuals, etc. There is already an action plan for farmers'

scientific quality, which was initiated by 19 departments led by the Ministry of Agriculture and the Chinese Association for Science and Technology as early as 2006, and relevant surveys and studies have been conducted. Surveys and studies on the scientific quality of leading cadres and civil servants are also more common.

The Current Situation of Journalists' Scientific Literacy Research in China

Overall, the index system for journalists' scientific literacy is not clear, and the nationwide assessment is relatively scarce.

Before studying journalist scientific literacy, we must make a clear positioning of scientific news disseminators that those engaged in scientific reporting are, first and foremost, journalists; meanwhile, "scientific" people, who determine that scientific journalism talents must grasp professional knowledge and ability and be familiar with the laws of scientific operation and the methods of scientific practice. In addition, science and technology news has a certain particularity. Some scholars have pointed out that science and technology news should not only have the basic elements of political and social news but also pay attention to two points. One is common, to make the facts clear, so that ordinary audiences can understand. The other is accurate, including facts; data and formulation should be accurate (Yang, 2012).

Journalist scientific literacy has not been paid as much attention as news business and journalism ethics. According to the China National Knowledge Infrastructure (CNKI) literature search, most of the relevant pieces of research start from the perspective of news communication to explore the issue of public scientific literacy. And there are only three direct studies on the scientific literacy of journalists, namely, media practitioners (Jie and Yanying, 2020), journalism practitioners (Xiulei, 2017), media, and media people (Gao, 2012), which mainly mention the problems and reasons for lacking scientific literacy. However, contents like connotation, indicator, measurement, and how to improve scientific literacy are not covered.

From the viewpoint of research objects, there are almost no studies that specify journalism practitioners as the main body, and the existing studies mainly focus on a certain type of identities such as journalists, editors, or media. There are 9 studies on journalist scientific literacy (4 for science and technology journalists and 1 for broadcasting hosts), such as *the scientific literacy enhancement of science and technology journalists* (Chuanshu, 2011). About 26 studies on the scientific literacy of editors can be found, mainly focusing on science and technology journals and scientific literacy cultivation strategies of science and technology editors, such as *editorial scientific literacy and academic quality of journals* (Fenxia and Yiqi, 2006). Besides, we can see 3 studies on the scientific literacy of media, such as analyzing the relationship between communication, science, and literacy from the media performance in the SARS epidemic (Jiang, 2003).

Cutting from the perspective of problem analysis and countermeasures, some scholars point out that the main reason for the low scientific literacy is, on the one hand, the lack of science literacy education in liberal arts majors in colleges and universities. On the other hand, the media pay less attention to science reporting and science journalist training (Gao, 2012). Countermeasures are also, mainly, from the perspective of media to end superstition with the scientific spirit, professional means, and rigorous attitude (Xi, 2014), with an insufficient exploration of the journalists themselves and other mechanisms.

In terms of the study date, one of the earlier papers was written by Tao (1987) in *News Front*, "*A Brief Discussion of Journalists' Scientific Literacy*," which mentioned the issue of journalist scientific literacy mainly from scientific cases, personal experiences, and stories.

In addition, expanding the scope a bit more, there are other perspectives of analyzing journalists' responsibilities and qualities such as science and technology communication and journalism, as well as media-based studies on science communication. All of these have some reference value and expand the reach of research on scientific literacy among journalists.

It is noteworthy that science and technology journalists have received more and more research attention as an independent and core group in the study of journalist scientific literacy. At present, domestic research on the scientific literacy of science and technology journalists focuses on the following aspects.

In summary, domestic research on journalist scientific literacy is still weak overall, with most of the research time concentrated before 2019, for the period of the epidemic and after the epidemic; special research on journalists' scientific literacy is still scattered in the discussion of media science communication. Specifically, the basic object determination and operational indicators definition are still relatively vague, biasing science and technology journalists, while lacking obvious differences from other journalists. There are few authoritative and professional studies around the country, with more status quo descriptions than theoretical analyses. In terms of countermeasures, there is a lack of effective methods to enhance scientific literacy by combining with journalism and business.

THE VALUE AND SIGNIFICANCE OF SCIENTIFIC LITERACY IN JOURNALISM

The lack of research reflects, to some extent, the lack of attention; meanwhile, the importance and value of journalist scientific literacy need to be further clarified.

Professional Characteristics and Responsibilities Determine That Journalists Act as a Bridge Between Science and the Public

From the perspective of journalists' professional characteristics, journalism pursues truthfulness, timeliness, objectivity, and intrinsic news value. Xinping (2001) analyzed the characteristics of the journalism profession from the perspective of the connection between journalism and other professions and the society and summarized that well informed information is its major advantage, broad communication is its special need, wide service is its work characteristic, great influence is its unique labor

effect, and heavy responsibility is its pressure and glory (Xinping, 2001).

The media have a strong social mobilization capacity and, at the same time, have an inescapable social responsibility for guaranteeing that the people enjoy and exercise their rights to be informed, to participate, to express, and to supervise. In the social division of labor, the journalism profession has specific social responsibilities, providing news and other information services to the society by means of news dissemination.

The special nature of journalism determines that journalists have to complete high-quality reports in a short period, which requires interdisciplinary and multi-disciplinary knowledge, and continuous improvement of their theoretical training, policy levels, and professional ability.

Journalists have always been known as "uncrowned kings," and, to some extent, they are the watchers of social justice. In science communication and tech news, according to the principles of two-level communication, opinion leadership, popularization, and diffusion of innovation, before making the public understand science, the media should understand science, that is, to make journalists understand science. Journalists, as a bridge between science and the public, bear important social responsibilities. They must report truthfully with scientific methods and perspectives to lead the audiences and the society to the path of scientific rationality.

Scientific Literacy of Journalists Is the Premise to Guarantee the Truthfulness, Objectivity, and Accuracy of News

"In the new media environment, the most fundamental thing is, actually, the truth of the news. To ensure truthfulness means to ensure scientificity. Scientific literacy is an important foundation for journalists, on which it is possible to talk about the high quality of reporting." (Respondent No. 1)

"Living in a high-tech city makes people learn new things consciously or unconsciously. It is a technology that forces you to think forward." (Respondent No. 9)

Respondent No. 13 spoke of a special report on a base station and mobile phone radiation; they interviewed the administration of radio and telecommunications bureau, operators, and experts from Shenzhen University, informing the public that the radiation of domestic base station to the human body is within a controllable range; the reality of turning pale at the mention of the "base station" has been changed.

"The basic scientific literacy allows us to make balanced reports with multiple interviews, ensuring the truthfulness and objectivity of the news." (Respondent No. 13)

"Science literacy is quite important. As a citizen, science literacy should be an intuitive reflection of the education you have received. As a journalist, your scientific literacy will directly affect your judgment on social phenomena, deciding whether you mislead society or play the role of answering questions and solving problems." (Respondent No. 22)

Modern society is complex and ever-changing, and the level of science and technology is constantly improving. If journalists do not have certain scientific knowledge and literacy to back them up, it is difficult to understand some technical terms accurately, and they cannot complete the screening, processing, and transmission of relevant materials, which, to some extent, will also result in blurred facts, distortion, and even false news. Misrepresentation of news not only violates the principle of the authenticity of the news and brings trouble to journalistic ethics but also makes media and journalists suffer from a crisis of trust. More importantly, it is related to the healthy development of the whole media industry. Yaping et al. (1986, p. 5) and others have pointed out that "the impact of true news can be calculated in arithmetical progression, while the impact of inaccurate news should be calculated in geometric progression."

Only with relevant scientific literacy can we examine and judge with a scientific eye, explore the deep causes with a scientific spirit, investigate and collect evidence through scientific methods, and, finally, report the events accurately and achieve the truthfulness of news.

Faced with professional issues, journalists should first search for and confirm objective materials with scientific attitudes and methods. As a journalist, you cannot just see the surface phenomena. Responsible media need to present the problem and essence objectively through in-depth investigation and digging. Moreover, the issue of medical malpractice needs to be identified by professional departments, not by the media's own words.

In this case, the media also had the problem of presumption, failing to provide balanced coverage and ignoring the voices of the medical staff. This is also unscientific and violates the principle of journalistic objectivity. The one-sided reports provide the public with one-sided information and bring more negative energy gathering such as indignation, which aggravates the tension between doctors and patients.

Good Scientific Literacy Can Enhance the Authority and Credibility of a News Report

Although new media provide equal opportunities for all social subjects to voice their opinions, the lack of gatekeepers and the uneven media literacy of netizens, coupled with the anonymous, open, pluralistic, and nuclear fission-like propagation effect, provide soil for the breeding of various rumors and gossips. More importantly, virtual reality in Internet society is likely to stimulate the emotional and irrational behaviors of netizens. In particular, when new situations and problems arise in the field of science and technology, the general public does not have the professional reserve and ability to distinguish them, and journalists are required to provide authoritative reports and analyses.

RESULTS AND ANALYSIS: COGNITION AND PRACTICE OF JOURNALIST SCIENTIFIC LITERACY

Scientific Literacy in the Eyes of Journalists

How do journalists understand scientific literacy? There are several points of view. Most respondents believe that scientific literacy should include scientific knowledge, scientific attitude, scientific method, and scientific spirit.

"*Scientific literacy should include two aspects: one is to have scientific knowledge; the other is to have an attitude, not blindly follow calm and objective scientific judgment attitude and do not believe rumors to ensure a scientific judgment of the mind and to verify the facts." (Respondent No. 8)*

"*Scientific literacy is one of the reserves of scientific knowledge, and the other is the attitude toward science. If it is fair and rigorous, we must see a lot of evidence to recognize it. Scientific literacy also includes logical thinking and openness to new knowledge." (Respondent No. 13)*

"*Scientific literacy, as I understand it, is not only about scientific and cultural knowledge but also morality, emotion, ability, and talent. Of course, it is also necessary to use technology to present the most valuable information to the audience." (Interviewee No. 14)*

"*Scientific literacy should include several aspects: first of all, scientific spirit, the way of thinking, and attitude. The second is scientific knowledge, being an expert in your field." (Respondent No. 15)*

"Scientific literacy should include not believing rumors, and not spreading rumors, having your judgment on some basic events and common things, and being able to use scientific knowledge, principles, and methods to solve practical problems." (Respondent No. 16)

"Science literacy should include knowledge of science, the use of scientific knowledge, and the effective communication of science. We should also have the spirit of not making assumptions." (Respondent No. 17)

"Scientific literacy should have two levels: One is scientific knowledge, and those with a background in literature, history, and philosophy are weak in this aspect. On the other hand, in attitude, we should not blindly follow others and adopt a calm and objective attitude toward scientific judgment. We should not believe rumors and ensure a scientific mind to verify facts." (Interviewee No. 19)

"Scientific literacy requires a certain amount of scientific knowledge... To guide your work with a scientific mindset, a macro or micro dialectical approach, there must be some way to get accurate data to grasp the news facts." (Interviewee No. 21)

"The first is the reserve of scientific knowledge, and the second is the attitude toward science, whether it is fair and rigorous, and you have to see a lot of evidence to accept it, but also logical thinking, a degree of openness to new knowledge." (No. 22 Respondent)

Others link scientific literacy with professional literacy from the perspective of occupation and profession. It is considered that scientific literacy is a very big concept, which needs to be mentioned in the professional ability and professional literacy of journalism and studied in the framework of the whole journalism work.

"Scientific literacy is a combination of professional and professional literacy." (Interviewee No. 2)

"The original purpose of journalistic professionalism is to convey information objectively, impartially, and accurately to the public. Scientific literacy refers to how well a journalist understands scientific knowledge. At present, the role of journalist scientific literacy for readers to obtain information has been higher than that of professional literacy. Scientific literacy is also part of professional literacy. The scientific literacy of journalists reflects the professional literacy of scientists." (Interviewee No. 6)

"At a macro level, scientific and professional kinds of journalism go hand in hand. Journalism is divided into two parts: one is the journalist's cognition; the other is the journalist's dissemination of information. The vast majority of news misinformation is not caused by journalists fabricating facts but by journalists' perception problems." (Interviewee No. 7)

"Scientific literacy should include political sensitivity, professional literacy, and, especially, the guidance of public opinion by mainstream media. So, it is not just a requirement for business competence; scientific literacy should be a part of professional literacy, an aspect. And technology is just a means." (Respondent No. 15)

"Working methods are very important for journalists, the ability to work hard and to socialize are congenital conditions, which also need acquired efforts to make the difference in professional quality." (Respondent No. 23)

"I think it is more of a method, a way of thinking about things... It is a scientific way of thinking. Journalists need to ask questions. You cannot eliminate all the blind spots in your specific knowledge because it is so broad, but it is also professional to have a better understanding of your field." (No. 25 Respondent)

This involves the universality and level of scientific literacy of journalists mentioned in this article, which is a basic requirement or a higher-level requirement. The author thinks that it should be a basic requirement first, and there should be a higher-level requirement for science and technology journalists. At the same time, the professional characteristics of journalists should be added to citizens' scientific literacy, and the difficulty of science and technology news reporting itself should be combined. How to popularize the abstruse scientific principles and how to find the audience's interest points in the science news to spread put forward higher requirements for the scientific literacy of journalists.

Status Quo of Journalists' Scientific Literacy

What is the scientific literacy level of Chinese journalists? This is an external measure. This survey specifically introduces the measurement of occupational scientific literacy, including three aspects: occupational knowledge, occupational methods, and professional spirit.

According to the statistics in **Figures 1**, **2**, more than half of the journalists in this survey have never been engaged in science and technology reports. Those who have been engaged in science and technology reports are divided into full-time engaged and part-time engaged, accounting for 3.6% and 40.1% respectively.

In addition, the time of professional science and technology reporting also varies: 17.2% <2 years, 47.6% for 5 years or less, 22.4% for 10 years or less, and only 12.7% for more than 10 years.

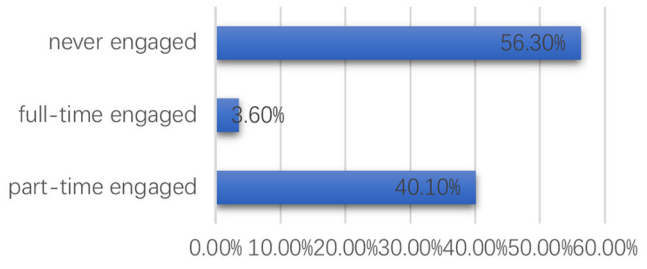

FIGURE 1 | Have you ever been engaged in science and technology reports?

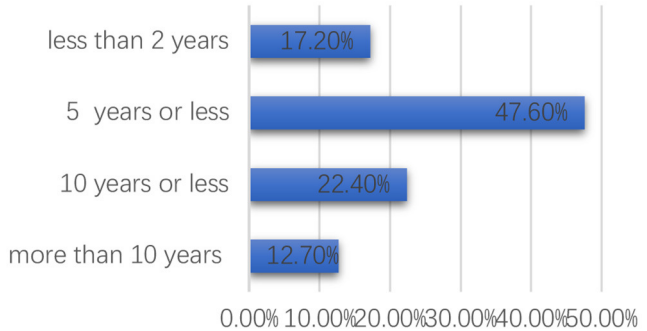

FIGURE 2 | Time spent covering science and technology.

As shown in **Table 1**, the qualified rate of professional science quality of journalists who have been engaged in science and technology reporting is 13.6% full-time and 7.5% non-full-time, higher than that of those who have not been engaged in science and technology reporting, which is 6%.

Especially for those who have been engaged in professional science and technology reports, the pass rate of professional science quality is much higher, indicating that professional science and technology reports are beneficial to ensure the level of professional science quality.

In addition, the duration of full-time science and technology reporting also has an impact on vocational science quality. According to **Table 2**, the qualified rate of those who have been engaged in full-time science and technology reporting for <2 years is only 6.5%, while the qualified rate of those who have been engaged for 5 years or fewer increases rapidly over time, reaching 13.4%. When the time reached 10 years or less, the pass rate increased to 18.5%.

However, the length and the qualified rate of high and low do not seem to have been related to the length of time for more than 10 years; the vocational science quality qualified rate fell to 8.7%, visible time to accumulate to a certain size; scientific quality is saturated, little room for growth and advancement, specific to the professional knowledge, professional approach, and professional spirit, too. The pass rate goes up and then down over time.

From the perspective of working years, the qualified rate of vocational science quality increased from 5.9 to 7.6% in the first 10 years of working and fell to 6.5% in the 11–15 years of working, and basically rose from 16–30 years and remained above 8.% in the following three periods. The peak appeared in 16–20 years, reaching 8.7%. With the accumulation of time, professional scientific literacy is gradually reflected, especially the knowledge in a wide range of fields involved in the news industry, methods and experience of long-term practice, and gradually nurtured professional spirit all need to be accumulated and revealed. In addition, in the early stage of journalists' career, the value of professional scientific literacy is low, which means there is still a lot of room for improvement, and it is also a golden stage to strengthen journalist professional scientific literacy. Vocational knowledge, in particular, rose steadily over time. See **Figure 3**.

Dilemmas in the Practice of Science Communication and Scientific Literacy

In the interview, journalists generally believe that the current level of scientific literacy in the industry is not high and needs to be further improved.

"Journalist scientific literacy is a little low. Although the reporters graduated from prestigious universities, working in radio stations are quite high; other media have problems like low entry barriers and no professional training for new recruits. With the influx of new reporters, it is inevitable that some reports are made just for eye-catching." (Respondent No 3)

"The spread of science is absent in our national education. It is impossible for journalists to become scientists. What they can do is just increasingly accumulate knowledge." (Respondent No. 4)

"It is universal for journalists to improve their scientific literacy." (Respondent No. 7)

"It is a question about national scientific literacy. Journalists and nationals have many invisible points on the ability of recognition; otherwise, fake information would not be spread so fast." (Respondent No. 9)

"Compared with foreign journalists, we fall so far behind in professionalism and cultural deposits, and media environment makes it impossible for us to cover a particular field as long as foreign journalists do. Disciplinary background is also an obstacle. Many foreign colleagues have doctor's degrees or have worked in a certain industry." (Respondent No. 22)

As the watcher of the society, at least compared with nations and other occupations, media professionals should have excellent literacy of politics, science, and legal. In order to cope with the ever-changing information age and afford the title of *uncrowned king*, they should also improve comprehensive literacy in practice.

On the one hand, journalists should have full comprehension of scientists' words and methods of scientific practice and also have own preliminary judgment from the perspective of both science and news. On the other hand, they should be able to inform the public about these scientific research results in an exact and easy-to-understand way.

"The focal point is how to translate scientific and technological terminology into acceptable language that everyone understands." (Respondent No. 10)

Journalists generally reflect difficulties in communicating with experts.

TABLE 1 | Have you ever been engaged in science and technology reports * career science literacy cross-list.

			Total score of career science literacy		Total
			0	1	
Have you ever been engaged in science and technology reports	Never engaged	Count	2,046	130	2,176
		Have you ever been engaged in science and technology reports%	94.0%	6.0%	100.0%
	Full-time engaged	Count	1,433	117	1,550
		Have you ever been engaged in science and technology reports%	92.5%	7.5%	100.0%
	Part-time engaged	Count	121	19	140
		Have you ever been engaged in science and technology reports%	86.4%	13.6%	100.0%
Total		Count	3,600	266	3,866
		Have you ever been engaged in science and technology reports%	93.1%	6.9%	100.0%

TABLE 2 | Time spent covering science and technology * career science literacy cross list.

			Total score of career science literacy		Total
			0	1	
Time spent covering science and technology	<2 years	Count	58	4	62
		Time spent covering science and technology%	93.5%	6.5%	100.0%
	5 years or less	Count	149	23	172
		Time spent covering science and technology%	86.6%	13.4%	100.0%
	10 years or less	Count	66	15	81
		Time spent covering science and technology%	81.5%	18.5%	100.0%
	More than 10 years	Count	42	4	46
		Time spent covering science and technology%	91.3%	8.7%	100.0%
Total		Count	315	46	361
		Time spent covering science and technology%	87.3%	12.7%	100.0%

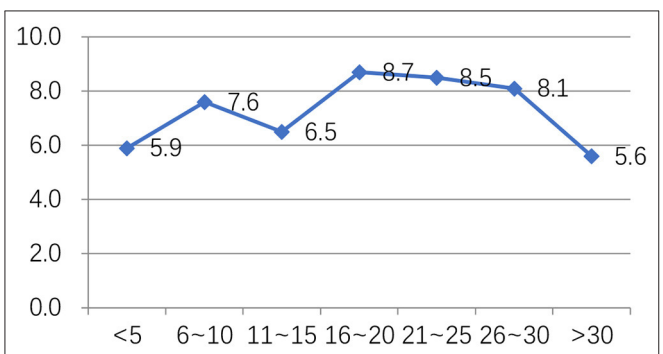

FIGURE 3 | Changes of professional science quality in different working years.

"The expert who is willing to stand out and accept interviews is only a certain one; others will not speak in public whether they agree or disagree." (Respondent No. 1)

"Authoritative and neutral experts that journalists can be accessible to are quite a few. Nowadays, more vocal experts mainly come from social sciences and economics; few in natural sciences." (Respondent No. 4)

What is more, as for support of government, there are different sounds in different areas. Journalists in Shenzhen think that the government has given much support; they can have a smooth communication with the government. On the contrary, journalists in Guangzhou revealed that the communication with the government was fraught with difficulties.

The information age is changing rapidly; information is exploding; science and technology news is becoming more and more available, having entered commercial operation when many technologies were still in their infancy. Journalists need to help the public understand science and provide scientific guidance, depending on the cooperation of departments and experts. Government departments and authoritative institutions need to further strengthen information disclosure, be the first to speak out, take the initiative to set the agenda, and cooperate fully with the media.

Ways to Improve Journalist Scientific Literacy

Regarding the ways and means to improve the journalists' scientific literacy, the educational layer seems to be

the most important one, which is confirmed by the following answer to the survey. The respondents mainly have two advocates, which are personal study and professional training.

"As for the way of learning, it can be personal study and reading; *a unit of centralized training and media training courses cooperate with universities. Lectures by experts and scholars from universities, who are the top industry figures, brought targeted training with obvious results." (Respondent No.1)*

"Professional knowledge training is of great importance. Comprehensive training is in need to enhance the quality of many aspects. For example, journalists need to attend orientation, industry trend training, technical training and so on." (Respondent No. 5)

"Training has a very limited role. Scientific literacy is a continuous process of accumulation by individuals." (Respondent No. 6)

Some other interviewees combined their own reporting fields to discuss specifically how to improve scientific literacy from medical and scientific aspects.

"I think the achievement of scientific literacy is really about 'bold guesses and careful proofs'." (Respondent No. 17)

"Basic training is still necessary. However, it mainly relies on your own practice to feel out and experience." (Respondent No.18)

"We have to look at these network views objectively and calmly, adopt a prudent attitude, not to follow blindly. As print media, we will give some correct guidance after seeing these incorrect views on the network." (Respondent No. 20)

"Journalists should have scientific literacy, but, whether they have professional training or not, they need to accumulate little by little." (Respondent No. 24)

CONCLUSION

Journalist scientific literacy is not only related to the improvement of their own business quality and ability, which can better complete news reporting and communication, and in relation to the construction of scientific communication capacity of the media. Media are the main role, carrier channel, and bridge hub of science communication, which undertakes the functions of information dissemination, principle interpretation, communication, and sharing, as well as public opinion guidance and education.

The current situation and problems of journalist scientific literacy need urgent attention.

As the overall level of civic scientific literacy in our country is not high when facing the threat of "information epidemic," it is more important to strengthen the timeliness, accuracy, and scientific information disclosed by official media.

In the post-epidemic era, the social construction of science communication is stronger, and the media need to interact with the scientific community in a high degree, so that authoritative knowledge can be transformed into popular science, and more high-quality popular science content can be produced in a faster and more accurate way in emergency science popularization. Not only should relevant information be released as soon as possible but also the dissemination of scientific research results. In particular, research institutions should timely and accurately popularize the latest achievements of virus origin, attributes, principles, and transmission channels to the public and realize the popularization and transformation of professional information.

In the future, journalists should also focus on the following aspects to improve their scientific literacy.

First, scientists, experts, and journalists must work together as a professional community with a unified goal.

Secondly, journalists should be more rigorous and prudent in carrying out checks, adhere to the spirit of science, verify the source, and correctly interpret the views of experts. The information should be scientifically argued before dissemination, such as rebuttal elements, qualifications, citing official data, and other multiple argumentative elements to improve credibility.

Besides, the use of artificial intelligence and other new technologies and the integration of new channels also help do a good job of timely and accurate dissemination of information on the epidemic. For example, designed by The Institute of Artificial Intelligence of Tsinghua University and RealAI, "COVID-19 EPIDEMIC AI Topic Analysis Platform" automatically captures and analyzes massive information, builds AI models, displays hot topics and trends, and monitors epidemic information in real-time.

Finally, reasonably configure the news media's editorial structure.

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DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the patients/participants was not required to participate in this study

in accordance with the national legislation and the institutional requirements.

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