Research on the Collaborative Model for Science Popularization Communication between Scientific Journals and Knowledge-based Opinion Leaders

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Abstract

Objective: To investigate the model construction and specific practical strategies for collaborative cooperation between scientific journals and knowledge-based opinion leaders in science communication.

Methods: Employing literature analysis and case study methods, this study dissects how scientific journals and opinion leaders can effectively collaborate in science communication activities, revealing the key constituent elements and operational mechanisms of their cooperation model.

Results: Collaborative science communication between scientific journals and opinion leaders can achieve complementary advantages and mutual benefits. A cooperative science communication model is constructed based on systems theory, encompassing an implementation system, a quality assurance and effect evaluation system, and an incentive system.

Conclusion: Scientific journals should actively integrate internal and external resources, establish and improve cooperation mechanisms, collaborate to innovate science communication forms, expand dissemination channels, and amplify the social value of research achievements.

Full Text

Research on Cooperative Science Popularization Models Between Scientific Journals and Knowledge-Based Opinion Leaders

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Abstract: [**Objective**] This study explores the model construction and practical strategies for collaborative science popularization between scientific journals and knowledge-based opinion leaders. [**Methods**] Using literature analysis and case study methods, we examine how scientific journals and opinion leaders can effectively coordinate in science communication activities, revealing the key components and operational mechanisms of their cooperation model. [**Results**] Cooperation between scientific journals and opinion leaders in science popularization can achieve complementary advantages and mutual benefits. From a systems theory perspective, we construct a cooperative science popularization model encompassing an implementation system, a quality assurance and evaluation system, and an incentive system. [**Conclusion**] Scientific journals should actively integrate internal and external resources, establish and improve cooperation mechanisms, jointly innovate science popularization formats, expand communication channels, and enhance the social value of research outcomes.

Keywords: scientific journals; opinion leaders; science popularization; cooperation

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In August 2022, the Ministry of Science and Technology, the Central Propaganda Department, and the China Association for Science and Technology jointly issued the *14th Five-Year National Science and Technology Popularization Development Plan*, which explicitly called for strengthening national science popularization capacity building and promoting comprehensive development of science popularization work to achieve coordinated progress between science popularization and technological innovation. As the primary platform for publishing research outcomes and the core venue for academic exchange, scientific journals can facilitate the dissemination and transformation of research results while enhancing public scientific literacy by strengthening their science popularization function. Leading international journals such as *Nature* and *Science*

have enhanced the social impact of research by establishing popular science columns that present complex, cutting-edge findings in accessible ways. *Nature* has even made "enabling the public to understand science and promoting the development of science education and culture" one of its publication missions.

Domestic peers have gradually recognized the importance of science popularization by scientific journals, with related research continuously increasing. These studies have focused on four main aspects: First, cooperation with mass media. For instance, Jia Hepeng [1] empirically demonstrated a positive correlation between mass media coverage and journal article impact, while Zhu Qianrong [2] and Yan Bei [3] explored practical pathways for cooperative science news reporting between journals and mass media from different perspectives. Second, omnimedia dissemination research. He Hongying [4] and Weng Yanqin [5] systematically summarized the methods, channels, and strategies for scientific journals' public science communication. Some researchers have approached the topic from more specific practical angles, such as Li Mingmin [6] elaborating on selection principles, writing essentials, and dissemination pathways for popularizing academic papers, and Jin Ling [7] detailing science communication methods and approaches through the case study of *Advances in Atmospheric Sciences*. Third, theoretical research. Bai Yan [8] constructed the generative logic of knowledge translation for Chinese scientific journals within social ecosystems by combining communication visibility and actor-network theory, while Xu Liping [9] built a knowledge service logic for the "secondary dissemination" of scientific journals. Fourth, new technology application research. Qiu Lei [10] summarized four application scenarios for AI large language models in the secondary dissemination of scientific journals. These studies have enriched the theoretical system of science popularization by scientific journals and provided beneficial guidance for practice.

However, most research still approaches the issue solely from the perspective of scientific journals, focusing on how journals can conduct science popularization relying on their own strength. Although a few studies have addressed cooperation with mass media, research remains relatively scarce on expanding cooperation scope, particularly with broader third-party partners such as knowledge-based opinion leaders. Scientific journals should break away from traditional closed operational models and actively seek cooperation with external resources to jointly build an open, shared, and interactive science popularization ecosystem. In this study, knowledge-based opinion leaders include paper authors, scholars, science writers, knowledge-based UP hosts (content creators), and other knowledge translators and disseminators who play a crucial bridging role in interpreting and transmitting science popularization information, helping to solve the "last mile" problem of making research results accessible to the public. This paper systematically constructs a cooperation model for science popularization between scientific journals and opinion leaders, and comprehensively explores practical cooperation strategies from the perspectives of implementation systems, quality assurance and evaluation systems, and incentive systems, thereby enriching the theoretical system of science popularization and provid-

ing both theoretical and practical value for broadening dissemination pathways, enriching content formats, and enhancing communication effectiveness.

1.1 Challenges in Autonomous Science Popularization by Chinese Scientific Journals

Science popularization by Chinese scientific journals can be divided into two models: autonomous dissemination and cooperative dissemination. Autonomous dissemination refers to journals relying on their own strength to deeply explore the popular science value of academic content, transforming it into forms easily understood by the public through rewriting and recreation, and disseminating it through their own channels. Cooperative dissemination, by contrast, involves journals actively seeking cooperation with other forces to achieve high-quality content creation and broader network dissemination through resource sharing and complementary advantages. The specific differences between the two models are shown in Table 1 .

Some excellent Chinese scientific journals such as *Science in China*, *Physics*, and *Chinese Journal of Traditional Chinese Medicine* have performed well in autonomous science popularization, but most journals still face numerous challenges. The main reasons are as follows: First, the sponsoring institutions of Chinese scientific journals are relatively singular, with 95.49% of publishing units publishing only one journal [11], leading to weak and fragmented operational strength that makes it difficult to integrate resources and conduct large-scale operations. Second, due to limited human, material, and financial resources, most journals focus their main efforts on quality review and editorial publishing of academic content, making it difficult to attend to mass communication work. New media capabilities are particularly weak, with editorial staff predominantly comprising acquisition editors and only 6.47% being new media personnel; moreover, up to 69.81% of journals have no new media staff at all [11], resulting in a serious lack of professional operational skills in science popularization.

1.2 Feasibility Analysis of Cooperative Science Popularization Between Journals and Opinion Leaders

With the rise of social media and video platforms, science popularization has become increasingly diversified and dynamic. In this context, opinion leaders have become indispensable key nodes in the science popularization ecosystem, leveraging their profound academic backgrounds, unique insights, and extensive influence. On platforms such as Zhihu, Weibo, Bilibili, and Douyin, they serve as bridges connecting research outcomes with public understanding. For example, the well-known science popularizer Yin Ye frequently cites cutting-edge research from *Nature* to produce popular science videos such as “Do Cancer Cells Prefer Nighttime Activity?”, “Can Eyeballs Be Revived After Death?”, and “COVID-19 Myth-busting: Does It Take 15 Days to Develop Antibodies After Recovery?”, which not only expand the dissemination scope of research findings but also enhance the visibility of scientific journals. Meanwhile, scien-

tific journals, as authoritative platforms for publishing research outcomes, face numerous dilemmas in science popularization, including insufficient new media operation capabilities, limited content innovation, and single-channel audience interaction. Cooperation between scientific journals and opinion leaders can achieve complementary advantages and mutual benefits.

Table: Science Popularization by Selected Knowledge-Based Opinion Leaders on Bilibili

Opinion Leader	Field	Followers	Total Views
Academician Wang Pinxian	Marine Geology	1.716 million	52.86 million
Grandma Wu Who Doesn't Do Practice Problems	-	47.5 million	-
Teacher Dai Who Loves to Be Precise	Mathematics & Science Education	256,000	8.95 million
Official Account of Teacher Li Yongle	-	1.4 billion	-
Zhang Chenliang (Infinite Small Light's Science Daily)	Biology & Ecology	9.637 million	6.4625 billion
-	History, Geography, Linguistics	1.647 million	12.458 million
Dr. Bo Shining	Physics & Interdisciplinary Humanities/Social Sciences	411,000	3.911 million
Dinosaur Hunter Xing Lida	Medicine & Health	496,000	10.593 million
-	-	263,000	364,000

Note: Statistics as of April 1, 2024.

For scientific journals, cooperation offers several benefits. First, it enhances content readability and appeal. Opinion leaders excel at transforming profound academic content into accessible, engaging, and interesting science popularization works, helping to attract more general readers to journal content. Second, it expands dissemination scope and influence. Opinion leaders possess large

fan bases and extensive social media influence, enabling journals to transmit academic achievements to broader audiences and increase journal visibility and social impact. Third, it promotes the social application of research outcomes. Through interpretation and promotion by opinion leaders, research results can be more quickly recognized by the public, facilitating the transformation and application of scientific and technological achievements and generating greater economic and social value.

For opinion leaders, cooperation also provides benefits. First, they gain access to high-quality content resources. Scientific journals aggregate massive amounts of cutting-edge research, serving as valuable content sources. Cooperation allows opinion leaders to obtain high-level original results firsthand, and these "exclusive resources" help them maintain a competitive edge in the crowded science popularization market. Second, it enhances content professionalism and authority. Through rigorous peer review and editorial standards, scientific journals can provide reliable academic support for opinion leaders' science popularization works, strengthening their credibility. Third, it facilitates personal growth. Cooperation with scientific journals helps opinion leaders continuously enrich their knowledge reserves, broaden academic horizons, increase opportunities for exchange and interaction with academic circles, and subtly elevate their own expertise.

In summary, cooperation between the two parties achieves win-win outcomes in multiple stages including content production, dissemination channels, and audience feedback. To sustain and maximize these cooperative benefits, both parties must further build stable cooperative relationships and continuously explore new operational cooperation models.

1.3 Constructing a Cooperative Science Popularization Model

Science popularization can be viewed as a complex system composed of multiple interacting subsystems. Systems theory holds that complex systems form organic wholes through the interdependence and interaction of subsystems, rather than simple aggregation of parts. Based on systems theory principles of wholeness, correlation, and dynamic balance, constructing a cooperative science popularization model between scientific journals and opinion leaders should include three core elements: an implementation system, a quality assurance and evaluation system, and an incentive system. First, the implementation system serves as the foundation of cooperation, primarily responsible for resource integration and investment. By constructing an institutionalized cooperation framework, it clarifies specific cooperation objectives, timeframes, forms, and the rights and obligations of both parties, ensuring the sustainability and standardization of cooperation. Simultaneously, the implementation system must conduct content planning based on precise audience insights and implement differentiated dissemination strategies according to the characteristics of different media platforms to maximize coverage and optimize communication effectiveness. Second, the quality assurance and evaluation system plays the role of process control and in-

formation feedback. Through rigorous review processes and scientific evaluation mechanisms, it ensures the scientific accuracy of popularization information. Simultaneously, it continuously monitors effectiveness during dissemination to provide scientific basis for strategy adjustment and optimization. Finally, the incentive system serves as an important power source for maintaining cooperation enthusiasm. Through comprehensive application of material and spiritual incentives, it stimulates both parties' cooperative passion and innovative capabilities, jointly promoting the sustainable development and innovation of science popularization work. These three systems mutually support and coordinate with each other to build a virtuous cycle of science popularization [Figure 1: see original paper].

2.1 Designing a Standardized Cooperation Framework

First, scientific journal editorial departments should widely solicit and screen suitable opinion leaders through their audience and author networks, actively approach them, understand mutual needs, and then discuss specific cooperation matters. To ensure long-term stability and standardized operation of cooperation projects, a cooperation agreement template should be designed to clarify core content including basic principles, models, rights, and obligations. This agreement should reflect both academic rigor and professionalism while considering the practical needs and characteristics of science popularization in new media environments, ensuring that both parties can freely exert their capabilities within the legal framework to achieve win-win cooperation.

(1) **Main clauses of cooperation agreement.** Cooperation objectives and duration: Clearly define the purpose of accelerating the social dissemination of scientific knowledge and set specific cooperation start and end dates. Cooperation model: Determine the cooperation form and clarify the roles and task distribution of both parties at each stage. Rights and obligations details: Specify the rights enjoyed by both parties, such as publication rights and attribution rights; and determine respective obligations, including ensuring the originality of science popularization content, providing high-quality works on schedule, and strictly adhering to academic ethics and industry standards.

(2) **Allocation of responsibilities and intellectual property protection.** Responsibility allocation and resolution mechanisms: Based on relevant laws and regulations such as the *Copyright Law* and actual circumstances, reasonably divide rights and responsibilities in content creation, publication, and promotion, and establish resolution mechanisms for potential issues. Intellectual property protection measures: Clearly stipulate attribution rights, scope of adaptation permissions, and specific conditions for usage rights, including but not limited to rules for using cooperative science popularization content on online media, print media, and other carriers.

(3) **Intellectual property sharing and revenue distribution.** Intellectual property sharing: Establish a mechanism for both parties to reasonably use each other's works or research results under specific conditions to promote maximized resource utilization. Revenue distribution scheme: Based on principles of fairness and justice, formulate economic benefit distribution plans including advertising revenue, paid reading income, and government project funding to stimulate both parties' enthusiasm and creativity.

The above cooperation agreement is only a framework text containing core elements. In practice, scientific journals should flexibly adjust agreement content according to different cooperation partners, projects, and methods to better adapt to both parties' needs and enhance cooperation adaptability. When signing publication agreements with authors, scientific journals should include clauses related to paper adaptation rights to ensure authors fully understand and agree to their papers being used for science popularization activities. Additionally, journals can attach detailed cooperation agreements to actively encourage paper authors to participate in science popularization activities.

2.2 Precision Planning Based on Audience Needs

Science popularization activities must be precisely planned around audience needs to ensure that content has both scientific value and meets public knowledge demands.

(1) **Topic selection should balance scientific value and news value [6].** Opinion leaders, with their keen insight into research frontiers and communication trends, can provide valuable suggestions for topic selection. Scientific journals should combine their own publication missions to create distinctive science popularization content. When selecting topics, they must maintain professional standards while paying attention to current events and public interests to ensure content has depth while attracting widespread public attention. For example, *Advances in Atmospheric Sciences* keenly identified extreme rainfall as a hot topic and quickly organized relevant experts to write the popular science article "Understanding Radar Maps, No Fear of Rain." Within 24 hours of publication, the article achieved over 6,500 WeChat reads and over 10,000 Weibo views, demonstrating the enormous potential of science popularization [7].

(2) **Audience segmentation is key to ensuring content relevance and effectiveness.** Different audience groups have significant differences in knowledge background, interests, and information reception habits. Therefore, the difficulty level and presentation format of science popularization content should be flexibly adjusted according to audience characteristics. For novice audiences, concise language and vivid, intuitive presentation forms should be used to popularize basic concepts and principles; for audiences with certain professional foundations, in-depth analysis and case

studies can increase content depth and professionalism. Additionally, for different age groups and audiences with different needs, demographic positioning should be refined and different communication strategies adopted, such as using storytelling and interactive methods to attract youth groups, while focusing on concise, clear, and graphically rich expressions for elderly audiences. *Chinese Journal of Traditional Chinese Medicine* delivers science popularization content with distinct demographic characteristics, providing targeted knowledge for people with dry eyes, high blood sugar, or those interested in dietary health. This precise positioning strategy not only improves science popularization effectiveness but also enhances audience trust and dependence on the journal.

2.3 Differentiated Dissemination Based on Platform Characteristics

Rational selection and effective utilization of various new media platforms are key considerations for enhancing science popularization effectiveness. Based on user knowledge service demand scenarios and leveraging the distinctive features and advantages of new media platforms, differentiated dissemination strategies should be formulated to scientifically match various new media channels and maximize the synergistic effects of combined communication across different media [12].

(1) **Social platforms focusing on hot topic discussions.** Social media platforms such as Weibo, with their powerful topic-setting functions, can quickly focus public attention on social hot issues and stimulate discussion. Relevant topic tags should be created around specific scientific themes to guide user participation and increase the exposure and influence of science popularization content. For example, on major scientific issues such as "novel coronavirus" and "global climate change," initiating specialized discussions on Weibo can attract broad audience participation, enabling rapid diffusion and in-depth dissemination of science information.

(2) **Graphic platforms focusing on in-depth analysis.** WeChat Official Accounts and vertical platforms feature in-depth analysis and personalized push services, which can not only effectively parse and disseminate complex scientific knowledge but also precisely deliver to target subscribers, fully releasing the educational value of science information. In addition to supporting opinion leaders in publishing science popularization information on major media platforms, scientific journals should actively encourage them to engage in interactive exchanges on vertical community platforms such as Zhihu, DXY.cn, and GitHub. These professional platforms provide opportunities for in-depth interaction with users, allowing scientific information to be conveyed closer to social contexts while ensuring both professional rigor and continuous communication effectiveness [8].

(3) **Short video platforms focusing on visual presentation.** Short video

platforms such as Douyin, Kuaishou, and Bilibili provide new spaces for science popularization with their intuitive, vivid, and easily understandable visual display characteristics. Science popularization videos mainly fall into two categories: lecture-type videos where opinion leaders appear on camera to explain concepts, and animation-type videos where scientific knowledge is made into cartoons. Opinion leaders transform abstract scientific knowledge into intuitive and vivid visuals, greatly enhancing audience immersion and comprehension. For example, when the Haihe River basin in China experienced its largest flood in 60 years in July 2023, "Global Geography Exploration" released an animated video titled "Haihe River, North China's Largest Water System, Five Dragons Absorbing Water in Tianjin" on Bilibili, vividly demonstrating the composition and hydrological conditions of the Haihe River basin and enhancing public awareness and prevention of flood disasters in the region.

3.1 Full-Process Quality Control

The core of science communication lies in ensuring the accuracy of disseminated content [13]. Quality control of science popularization content is a basic requirement for ensuring effective transmission of scientific information and preventing public misguidance. Therefore, it is necessary to establish a quality control system covering the entire process from "planning—production—dissemination" of science popularization content.

(1) **Control at the planning stage: Strictly control the source quality of science information.** Scientific journals should fulfill their responsibilities to ensure information accuracy. All disseminated science information must be peer-reviewed research outcomes that have undergone careful verification of original literature, strict confirmation of data sources, and thorough examination of conclusion derivation processes to eliminate factual or knowledge errors. Simultaneously, comprehensive investigation of author qualifications is an important step to avoid dissemination distortion, including verifying whether authors have long-term research experience in relevant fields and referencing their related publications in domestic and international journals [2]. When *Aerospace Knowledge* magazine supplies content to mass media, it adheres to high-quality control standards with strict content screening and review, making it the preferred partner for aerospace programs in some mass media [13].

(2) **Control at the production stage: Strengthen the pre-review system for science popularization products.** In the process of transforming academic papers into popular science works, excessive simplification or distortion that leads to loss of knowledge connotation should be avoided. Experts and scholars in various fields should be invited to participate in reviewing science popularization content to help judge its scientific value and accuracy. For example, *Acta Pharmacologica Sinica* consistently maintains scientific rigor in its science popularization efforts,

ensuring information authenticity and reliability through strict expert review and screening. Especially for controversial topics, expert opinions can effectively circumvent potential risks [2].

(3) **Control at the dissemination stage: Establish a sound information error correction mechanism.** Dedicated feedback channels should be established to accept supervision and corrections from peer experts and the public. Once errors are discovered, immediate response and timely handling of user questions and suggestions about science popularization content are required, with prompt corrections and public explanations to maintain the brand image and credibility of both parties.

Additionally, technical-assisted review tools, particularly artificial intelligence technologies, should be actively introduced to verify relevant viewpoints and factual data. This can not only effectively reduce errors but also lower labor costs and improve review efficiency.

3.2 Effect Evaluation and Continuous Optimization

To accurately monitor and measure the real influence and deep value of science popularization information in social dissemination and provide basis for adjusting communication strategies, it is necessary to construct a comprehensive and accurate evaluation system for cooperative science popularization.

(1) **Combine quantitative indicators with qualitative evaluation.** In quantitative evaluation, network metrics such as read counts and forwarding frequency serve as effective benchmarks for measuring the initial communication power and public acceptance of science popularization content. However, these hard data only reflect the superficial reach of information and fail to reveal the degree of internalization into individual knowledge reserves, audiences' deep understanding of scientific content, or long-term potential social impacts. To overcome the one-sidedness of quantitative evaluation, qualitative evaluation should be combined. Through user satisfaction surveys, expert evaluations, and other methods, we can better understand the substantive contributions of science popularization information in meeting diverse audience needs and enhancing public scientific literacy.

(2) **Establish a medium- and long-term science popularization effect tracking mechanism.** The effect of science popularization activities on improving public scientific literacy often has a time lag and requires a period to manifest. Therefore, the evaluation system should include medium- and long-term effect monitoring. Combining social network analysis theory, we should comprehensively observe the diffusion paths and life cycles of science popularization information in networks. Conducting before-and-after comparison studies at intervals can analyze trends in public scientific literacy changes after participation in science popularization activities and assess the long-term social and economic benefits of science popularization

projects to accurately judge their long-term value.

Constructing and continuously improving the science popularization effect evaluation system is a gradual and iterative process. Based on feedback from evaluation data, communication strategies should be dynamically adjusted and optimized to ensure continuous improvement and innovative upgrading of science popularization work, thereby achieving optimal balance among communication efficiency, content quality, and social benefits.

4.1 Multi-Dimensional Incentive Measures for Opinion Leaders

When designing and innovating incentive systems, the multi-dimensional needs of opinion leaders should be fully considered to provide them with both substantive material and spiritual incentives. This not only benefits the personal development of opinion leaders but also stabilizes and deepens cooperative relationships.

(1) **Economic interest incentives.** Economic incentives are important means to directly mobilize the enthusiasm of opinion leaders. Journals can provide economic returns for opinion leaders' participation in creating and promoting science popularization information through payment of royalties, profit sharing, and project funding. For example, reasonable royalty standards can be set to encourage the creation of high-quality original science popularization articles; for works with extensive online dissemination and significant social impact, the profit distribution ratio can be flexibly adjusted and increased based on quantitative indicators such as clicks, reads, or downloads.

(2) **Career development incentives.** Science popularization activities should be integrated with opinion leaders' career development by providing opportunities for academic recognition and enhanced social status. For opinion leaders pursuing professional title promotion, a science popularization achievement recognition system should be established to incorporate their science popularization contributions into the title evaluation system as important evaluation indicators. Additionally, science popularization achievements should be included in the performance evaluation system for researchers, giving them due recognition in awards, excellence evaluations, and project applications. For example, in 2017, Zhejiang University issued the *Implementation Measures for the Recognition of Outstanding Online Cultural Achievements at Zhejiang University (Trial)*, which explicitly included outstanding online cultural achievements in the university's research achievement statistics, various promotion and appointment evaluations, and awards for excellence [14].

(3) **Reputation and honor incentives.** For opinion leaders not in the professional title series, journals can jointly establish awards such as "Science Popularization Star" or "Outstanding Science Popularization Author" with relevant societies and associations to recognize opinion leaders

with outstanding contributions. By widely publicizing their science popularization deeds and enhancing their public recognition and reputation, this can not only stimulate their enthusiasm for science popularization but also create positive word-of-mouth effects and demonstration roles.

4.2 Internal and External Support Conditions for Scientific Journals

To fully mobilize the enthusiasm of scientific journals in science popularization, good internal and external support conditions should be provided at different levels: high-level (policy), medium-level (projects), and low-level (training).

(1) **Policy and institutional guarantees.** The *Law of the People's Republic of China on the Progress of Science and Technology* has explicitly proposed improving incentive mechanisms for science and technology popularization, encouraging researchers and journals to actively participate in science popularization activities. It is recommended to further adjust policies to incorporate science popularization work into the evaluation system for scientific journals. On the basis of existing citation metrics such as impact factor and H-index, new indicators reflecting science popularization influence should be introduced, such as science article read counts, forwarding frequency, and media citation times, or new evaluation indicators such as "science popularization contribution" or "public influence" should be established as important bases for journal assessment, rating, and funding allocation.

(2) **Establishment of funding projects.** Considering the long-term and continuous nature of science popularization work, stable financial support helps scientific journals plan and implement long-term science popularization projects. It is recommended to establish a special fund project for "Public Dissemination of Innovative Achievements by Scientific Journals" to specifically support the creation and dissemination of excellent science popularization content, reducing the economic burden on journals and enabling them to focus more on innovation and quality improvement of science popularization content.

(3) **Media literacy training.** Scientific journals should attach great importance to and strengthen professional training for their teams in media operation and science popularization content creation, enabling editorial staff to master the characteristics and strategies of information dissemination in new media environments and improving their ability to plan popular science topics. A long-term mechanism for science popularization talent cultivation should also be established, including regular career development training, scientific performance evaluation systems, and recognition of outstanding science popularization contributors to ensure continuity in talent team building.

5.1 Discussion on Model Applicability

The cooperation model between scientific journals and opinion leaders plays an important role in promoting the transformation of research achievements from academia to the public domain through collaborative innovation and knowledge sharing. However, due to significant differences among journals in disciplinary characteristics, knowledge attributes, discourse systems, and audience groups, the applicability of the cooperation model requires careful consideration based on specific circumstances. For example, for scientific journals focusing on unpopular disciplines or pure basic research, science popularization is difficult and the audience is narrow, making it challenging to attract high-quality opinion leaders; consequently, the applicability of such cooperation models is relatively low.

Given the varying science popularization needs across different disciplines and audiences, scientific journals should select appropriate opinion leaders and design personalized cooperation plans based on specific circumstances. Simultaneously, journals should continuously summarize cooperation experiences and explore more diversified cooperation methods to adapt to evolving science popularization needs. It is worth noting that although this study focuses primarily on scientific journals, the proposed cooperation model also has reference value for academic journals in humanities and social sciences fields such as history, law, economics, and sociology.

5.2 Potential Problems and Coping Strategies

In the cooperation process between scientific journals and opinion leaders, a series of challenges are inevitable, such as interdisciplinary collaboration, balancing depth and breadth of science popularization, and difficulties in evaluating communication effectiveness. Most problems require case-by-case handling; the following discussion focuses on important issues that may arise in the three major systems.

(1) **Partner selection and stable cooperation in the implementation system.** Selecting appropriate cooperation partners is the primary difficulty in cooperation between scientific journals and opinion leaders. Journals should comprehensively consider factors such as opinion leaders' professional backgrounds, communication influence, content production capabilities, and value alignment, using strategies of small-scale trial operation and gradual expansion to continuously optimize the partner pool. Meanwhile, the stability of cooperation models is often constrained by multiple factors, such as shifts in opinion leaders' professional interests, adjustments to both parties' interest demands, and changes in career development directions. To address these challenges, first, exit clauses should be clearly defined in cooperation agreements, including advance notice periods, reasons for exit, and compensation measures to provide clear guidance for both parties. Second, a cooperation network containing multiple

opinion leaders should be constructed to avoid over-reliance on a single leader. Additionally, backup opinion leaders should be continuously identified and cultivated to ensure alternative candidates can be quickly found when necessary. Finally, emergency plans should be formulated to ensure the continuity of science popularization under unexpected circumstances.

(2) **Conflict of interest and ethical issues in the quality assurance system.** As cooperation deepens, conflicts of interest may arise between scientific journals and opinion leaders. For example, opinion leaders may exaggerate or distort research findings for commercial purposes, damaging the credibility of scientific journals. When dealing with sensitive topics or controversial research outcomes, balancing academic freedom with social responsibility is also an important issue. To solve these problems, clear conflict of interest management systems and ethical guidelines should be established to define boundaries for both parties in dissemination. Simultaneously, an ethics review committee composed of third-party experts should be established to evaluate and guide controversial content.

(3) **The "diminishing marginal utility" problem in the incentive system.** Over time, existing incentive measures may gradually lose their appeal, leading to decreased incentive effects. To address this issue, incentive forms need to be continuously innovated, with emphasis adjusted timely according to opinion leaders' needs at different stages and types, providing personalized incentive schemes. For example, for senior opinion leaders, more opportunities to participate in planning major science popularization projects or serving as science popularization consultants can be provided; for new opinion leaders, more display platforms and resource support can be offered. Additionally, competition mechanisms can be introduced to maintain cooperation vitality through survival of the fittest.

6 Conclusion

Scientific journals face multiple challenges in science popularization, and cooperation with knowledge-based opinion leaders provides new ideas for addressing these challenges. However, deepening cooperation and perfecting models is a dynamic evolutionary process requiring continuous effort and innovation from all parties. In the future, scientific journals should continue to explore broader cooperative relationships, continuously optimize cooperation strategies, and flexibly address emerging challenges such as deepening interdisciplinary collaboration, personalized customization of science popularization content, and application of new communication technologies. Simultaneously, policymakers and all sectors of society should provide more support, guaranteeing the long-term development of science popularization work from the institutional level and creating a more open, inclusive, and supportive science popularization ecosystem.

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Author Contributions Statement:

CHENG Fu: Designed the research topic, research plan, and outline; wrote the paper.
LIU Hongxia: Participated in topic design and provided writing suggestions.
LI Xiang, WANG Yajiao: Collected and organized relevant materials and data.
YUAN Genshen: Provided research suggestions and revised the paper.

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