Practical Exploration of Information Literacy Education for Frontline Researchers in Research Institutes (Postprint)

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Abstract

[Purpose/Significance] This study summarizes the information literacy education practices conducted by the National Science Library, Chinese Academy of Sciences for frontline researchers, providing best-practice cases for research information literacy education.

[Method/Process] The practical exploration of information literacy education for frontline researchers in institutes is summarized from aspects including service network, content system, teaching staff, service platform, service forms, and publicity channels. Based on exploratory practices during the pandemic and post-pandemic periods, and through questionnaire surveys analyzing expert opinions, new development strategies for information literacy education for frontline researchers are proposed.

[Results/Conclusion] In the future, it is necessary to establish a long-term mechanism for real-time communication of needs, and through measures such as effective incentives, open collaboration, and exploring crowdfunding, promote further innovative development of information literacy education for frontline researchers.

Full Text

Practical Exploration of Information Literacy Education for Frontline Researchers in Institutes

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Abstract:
[Purpose/Significance] This paper summarizes the practices of information literacy education conducted by the National Science Library of Chinese Academy of Sciences (CAS) for frontline scientific research, providing best-practice cases for research information literacy education. [Method/Process] Based on the training service network, curriculum system, teaching staff, training platform, service forms, and publicity channels, this paper summarizes the characteristics of the practice and exploration of information literacy education for scientific research frontline. Drawing upon exploration during the pandemic and post-pandemic periods, and through questionnaire surveys and analysis of expert opinions, this paper proposes new development strategies for information literacy education for research frontline. [Result/Conclusion] In the future, it is necessary to form a long-term mechanism for real-time communication of needs, and promote further innovation and development of information literacy education for research frontline through effective incentives, open cooperation, and exploration of crowdfunding measures.

Keywords: information literacy education; training service; research institute; scientific research users
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1 Research Background

The concept of information literacy was first proposed by P. G. Zurkowski, Chairman of the American Information Industry Association, in 1974 [1]. In 1989, the American Library Association (ALA) explicitly defined information literacy as "the ability to know when information is needed and to effectively locate, evaluate, and use the required information" [2]. The *Library · Information and Documentation Science Terms* published by the China National Committee for Terms in Sciences and Technologies in 2019 defines information literacy as "the ability to utilize information tools and resources, as well as the ability to select, acquire, and identify information, and to process, transmit, and create information," and information literacy education as "training users in information query, acquisition, evaluation, and usage capabilities" [3]. With the development of information technology and the times, people increasingly recognize information literacy education as an important means for cultivating lifelong learning abilities, competitiveness, and innovation capabilities, playing a significant role in training high-level innovative talents.

As understanding deepens, the connotation of information literacy continues to enrich and develop. The *ACRL Framework for Information Literacy for Higher Education* released by the Association of College and Research Libraries (ACRL) in 2015, based on the theory of "meta-literacy," considers information literacy essentially a form of meta-literacy that gives rise to other literacies

[4], providing new guidance for understanding information literacy in the new information environment. In early 2020, Jing Li et al. proposed the concept of "pan-information literacy education" [6], pointing out that information literacy should not be limited to information itself but should expand its boundaries from users' tasks, scenarios, and needs, integrating information literacy throughout the process of research literacy and innovation literacy, and incorporating information literacy capabilities into professional core competencies to more effectively support research and innovation processes. This constitutes the theoretical foundation for the information literacy education for frontline institutes discussed in this paper.

Most information literacy education at home and abroad is carried out through libraries, particularly through curriculum education for various students in higher education systems, with related research primarily focusing on higher education and curriculum construction perspectives [7]. ACRL's *Information Literacy Competency Standards for Higher Education* [8] released in 2000 and *Framework for Information Literacy for Higher Education* [4] released in 2015 have led the continuous expansion and deepening of theoretical research and practical exploration in information literacy education worldwide. The Steering Committee for Library and Information Work of the Ministry of Education organizes the "National Information Literacy Education Seminar for Universities" annually, which has played an important role in promoting curriculum reform and incentivizing the development of information literacy education in university systems [9].

Public libraries both domestically and internationally have also conducted numerous studies and practices in public information literacy education [10], primarily targeting the general public. Many public libraries in the UK conduct offline information literacy education close to daily life for the public and share training resources through large online education platforms such as "LearnMyWay" and "UK Online Centres" to expand online training services [11]. In recent years, public libraries in China have mainly targeted specific groups such as teenagers and the elderly in public information literacy education. In 2019, the Chinese Library Society and other units initiated the *Action Initiative for Improving Chinese Citizens' Information Literacy Education* [12], further promoting the popularization and development of public information literacy education in China.

Research specifically addressing information literacy education for frontline researchers in research institutes is relatively scarce, with few studies primarily authored by scholars from the Chinese Academy of Sciences system. Unlike universities, CAS integrates research institutes, academic divisions, and educational institutions, comprising 12 branches, over 100 research institutes, 3 universities, more than 130 national key laboratories and engineering centers, and over 270 field observation stations, with 71,000 formal employees and 64,000 graduate students [13]. This unique management system, dispersed geographical locations, and high-end research community require the National Science Library

of Chinese Academy of Sciences (hereinafter referred to as "the Library") to explore and construct an information literacy education system with its own institutional characteristics for researchers and graduate students, based on its own academy-specific context while drawing on experiences from university and public libraries. From the perspective of research institutes, this paper summarizes the practical characteristics of CAS's information literacy education for frontline research, aiming to provide best-practice cases for research information literacy education.

2 Development of CAS's Information Literacy Education for Frontline Researchers

The Library's information literacy education for frontline researchers can be traced back to the 2003 "Service to 100 Institutes—All-Institute User Training and Information Service" program, which aimed to enable researchers throughout the academy to fully understand and utilize the resources and services of the National Science Digital Library (CSDL) and the all-institute library and information system [14]. Since 2006, when the Library established a dedicated subject service team, information literacy education for frontline researchers has transformed from a temporary task into normalized work with a stable institutional guarantee.

With the deepening of research and practice, the guiding ideology for the Library's information literacy education for frontline researchers has continuously evolved (see Figure 1 [Figure 1: see original paper]). In 2013, the Library proposed embedded information literacy education [15], advocating for an education model integrated into the research process and oriented toward practical problems, promoting the combination of information literacy education with users' research workflows, and gradually breaking through the traditional information literacy education framework centered on library utilization and literature retrieval. In 2017, the Library proposed building a "five capabilities" information literacy education system oriented toward the entire research process, deploying and developing training content design and cultivation across five themes: scientific information retrieval, disciplinary trend analysis, research tool application, research data management, and paper writing and submission. In 2020, the Library formally proposed the pan-information literacy education theory [6], advocating for extending, expanding, and transcending information literacy itself, and understanding and grasping the essence and needs of information literacy education within a larger space, context, and perspective to enhance researchers' research and innovation capabilities.

After 14 years of continuous exploration, the Library has formed a dual-track information literacy education service pattern consisting of an information literacy education curriculum system for the University of Chinese Academy of Sciences and an information literacy education training system for frontline re-

searchers in institutes. Through continuous promotion by the CAS Library and Information Capacity Building Project, it has developed distinctive information literacy education mechanisms, teams, content, methods, and platforms, meeting the needs of CAS researchers and graduate students for information literacy capability enhancement. The information literacy education curriculum system for the University of Chinese Academy of Sciences has been introduced in a separate paper [6]; this paper focuses on the practical exploration of constructing the information literacy education training system for frontline researchers in institutes and reflections on its future development strategies.

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3 Practical Exploration of Information Literacy Education for Frontline Researchers

3.1 Establishing a Collaborative Institute-Academy Joint Training Service Mechanism

Providing information literacy education and training services for research users across more than 100 research institutes distributed nationwide must rely on a collaborative service mechanism throughout the academy. Through project deployment, task decomposition, and pilot construction, the Library has fully leveraged its leading role as the academy-level center, the regional guiding role of regional centers (Chengdu, Wuhan, Shanghai, and Lanzhou), the centralized campus role of the University of Chinese Academy of Sciences, and the important node role of institutes located in comprehensive science centers such as the Hefei Institutes of Physical Science. Through the responsibility bond of subject librarians collaborating with responsible institute libraries, it has effectively mobilized over 100 institute libraries throughout the academy to collaboratively carry out information literacy training services for frontline researchers, as shown in Figure 2 [Figure 2: see original paper].

3.2 Establishing a Pan-Information Literacy Education Content System

Under the guidance of pan-information literacy theory, the content system of CAS's information literacy education for frontline researchers has been greatly expanded, breaking away from the traditional information literacy education framework centered on library utilization and literature retrieval, and beginning to form a pan-information literacy education content system centered on supporting research innovation literacy capabilities. The current content framework (see Figure 3 [Figure 3: see original paper]) includes resource services, information retrieval, tool software, intelligence analysis, patent application, data management, intellectual property, writing and submission, research integrity, research methods, reading promotion, and will be further expanded and refined according to actual needs.

3.3 Developing an Open and Cooperative Training Faculty Team

An excellent faculty team is the foundation and guarantee of information literacy education and training. The Library's subject service team has been deeply engaged in information literacy education for 14 years, forming a core faculty team based on subject librarians from the academy-level and regional libraries, and has played an indispensable leading role in all-institute information literacy education and training by collaborating with institute-level librarians. However, as information literacy education expands toward pan-information literacy education, more diverse professional training content requires participation and cooperation from professional faculty. For example, intelligence research training requires cooperation from intelligence researchers, writing and submission training requires participation from publishing editors, the best instructors for research methods training are scientists with rich research experience, and introduction of new database functions requires support from database vendors.

To better meet the diverse and in-depth training needs for research innovation capability enhancement in the frontline, it is urgent to break through the limitations of our own team's capabilities and establish a more open and cooperative faculty team. As shown in Figure 4 [Figure 4: see original paper], we take the consulting service team as the core, strengthening close collaboration with various departments within the Library on one hand, and establishing cooperative mechanisms with publishers, database vendors, experts inside and outside the academy, researchers, and graduate students on the other hand. According to training topics, we invite corresponding outstanding faculty to join information literacy education and training, forming a multi-participant information literacy education and training system to jointly promote the enhancement of training capabilities for frontline researchers.

3.4 Continuously Developing and Improving Training Service Platforms

Facing the digital research and information environment, how to use new technological means to improve training service efficiency and better meet the distributed needs of the entire academy has become a problem that information literacy education teams always need to consider and solve. With the collaborative support of information technology teams, information literacy education has continuously upgraded and transformed from face-to-face training services to networked and platform-based services. In 2010, the first-generation information literacy education service platform based on WIKI was developed to provide training courseware services for users; in 2015, the second-generation information literacy education service platform based on MOOCs was developed to provide MOOC video courses; in 2017, the "China Science News" Sina Weibo new media live broadcast platform was utilized to conduct online live training, enriching the dissemination and interaction methods of information literacy education and training; in 2020, the "CAS Research Information Literacy Lecture Hall" [16] was created as a professional online training service

platform, achieving multi-scenario learning layout for users and promoting the further high-quality and efficient transformation and upgrading of information literacy education for frontline researchers (see Figure 5 [Figure 5: see original paper]).

The "CAS Research Information Literacy Lecture Hall" can provide diverse live teaching modes such as large open classes, large classroom sessions, and small classroom sessions, and can provide diversified learning forms including premium course on-demand, interactive live broadcast, replay, and multimedia interstitial broadcast, thereby maximizing the satisfaction of all-institute users' needs for information literacy education and training across different disciplines, types, levels, regions, and times. At the same time, it can also realize collaborative organization of training across different locations through dual-teacher classrooms, breaking geographical restrictions and boundaries between institutes, sharing master teacher resources, and enabling one instructor to drive all-institute users.

3.5 Exploring Multi-Scenario Training Service Forms

Through institute-academy collaboration across the entire library and information system, seven typical models for information literacy education for frontline researchers have been established, providing targeted training services for users at different levels and with different needs through multi-scenario layout. The seven typical models include:

(1) **Online Training Model**: Building the "CAS Research Information Literacy Lecture Hall" and "China Science News" online live training brands, widely cooperating with experts inside and outside the academy to provide high-end and attractive training content, with one training session radiating to all-institute users; conducting premium course recording work, providing all-institute researchers with online learning opportunities during their leisure time through the CAS Continuing Education Network.

(2) **Institute Orientation Model**: Embedding information literacy education and training into institute orientation for new students and employees, which has become the mainstream training model for new students and employees throughout the academy's institutes to understand library resources and services.

(3) **Embedded Academic Activity Model**: Organically embedding information literacy education and training into various academic activities or training activities across the academy, such as embedding "Literature Big Data Assisting Precise Talent Recruitment" training content in personnel director training classes, and embedding training content such as "How to Enhance Academic Influence," "How to Become a Reviewer," and "Patent Application Process" in youth promotion association activities, assisting in the enhancement of information literacy capabilities of scientific research and management backbones.

(4) **Competition Activity Model**: Stimulating user participation enthusiasm through competition activities. For example, the Shanghai Life Science Information Center held the "Biological Software Operation Video Collection Competition," and the University of Chinese Academy of Sciences held the "ArcGIS Software Operation Video Collection Competition," selecting multiple excellent micro-videos produced by users that have become important video training resources.

(5) **Centralized Campus Model**: In the centralized campuses of the University of Chinese Academy of Sciences and branch education bases, where graduate students are most concentrated and training needs are strongest, in addition to vigorously cultivating information literacy education credit courses for graduate students to elect, the academy-level and regional libraries also collaborate with the University of Chinese Academy of Sciences Library and branch education bases to hold series of special training lectures to meet the information literacy enhancement needs of various graduate students during their centralized campus learning stage.

(6) **Regional Node Model**: Leveraging the role of important regional nodes, such as the location of the Hefei Comprehensive National Science Center, to jointly plan series of training lectures with the Hefei Institutes of Physical Science Library, and through full collaboration with the Graduate School, Personnel Department, and various institutes, deliver training directly to various research users.

(7) **Institute-Level Course Model**: In institutes with strong faculty resources, such as the Shanghai Institute of Technical Physics, institute-academy collaboration cultivates institute-level information literacy credit courses, further strengthening systematic information literacy education and training for institute doctoral students.

3.6 Conducting Diversified Training Promotion and Publicity

Compared with traditional information literacy education models, information literacy education under the new situation has changed in various aspects including form, content, faculty, and information channels. These changes have also inspired our thinking about reshaping some key issues in information literacy education for frontline researchers, such as how to plan training content that best meets user needs during and after the pandemic, whether online training will replace offline training, how to organize training faculty teams, how to build institute-academy collaborative training mechanisms, how to position subject librarians, and how to carry out promotion and publicity.

To better enable users to timely understand training information, a three-dimensional online and offline combined publicity and promotion channel has been established through the institute-academy collaborative training network.

Online publicity channels include: (1) WeChat Official Account dissemina-

tion: For example, training preview information is sent through the Library's "China Science News" and "Zhongke Zhihui" WeChat Official Accounts, and widely forwarded by the WeChat Official Accounts of the University of Chinese Academy of Sciences Library and various institute libraries. (2) Portal website dissemination: For example, information is published in the "Training Preview" column of the "CAS Research Information Literacy Lecture Hall" website, and the "Announcement Board" of each institute library's homepage follows up with the information; some have also embedded the URL of the "CAS Research Information Literacy Lecture Hall" into their library homepage to enable users to obtain lecture hall information promptly. (3) WeChat Group dissemination: Training organizers send training information to the "All-Institute Information Literacy Education Group" to all institute information literacy responsible librarians, who then forward it to their unit's users. (4) Setting up next-issue previews: After each live course ends, the host announces the next training preview. (5) Other online channels: Some responsible librarians also send training information to users through traditional channels such as QQ groups or email.

Offline publicity channels include: (1) Posting training publicity posters in institutes; (2) Instructors releasing information to students in classrooms, etc.

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4 New Strategies for Information Literacy Education for Frontline Researchers—Based on Exploration and Practice During and After the Pandemic

The sudden COVID-19 pandemic has brought disruptive educational technology revolution globally, forcing the rapid transformation from previously offline-dominated education models to online education models. The information literacy education and training practice under this new model is an important exploration with guiding significance for the transformation of information literacy and will trigger changes in the information literacy education ecosystem. The year 2020 is a critical year for the transformation and upgrading of information literacy education for frontline researchers. With the implementation of the pan-information literacy education concept and the increasing maturity of online training models, new scientific research information literacy education practices are being carried out in an orderly manner.

In February 2020 during the pandemic, the Library quickly responded to the needs of frontline researchers, launching the "CAS Research Information Literacy Lecture Hall" live training. Multiple departments collaborated and mobilized multiple publishers and experts inside and outside the academy to jointly participate in online teaching, providing information literacy training lectures through online video to assist frontline researchers in enhancing their scientific research innovation capabilities throughout the entire process of information searching, acquisition, management, writing, and application. By the end of December, the Lecture Hall had organized over 100 live courses provided by more

than 90 experts, attracting more than 200,000 viewers. Users came not only from various CAS institutes but also from universities, provincial academies, and other research institutions across the country, making it a widely beneficial online training brand for frontline researchers.

Compared with traditional information literacy education models, information literacy education under the new situation has changed in form, content, faculty, information channels, and other aspects. These changes have also inspired our thinking about reshaping some key issues in information literacy education for frontline researchers, such as how to plan training content that best meets user needs during and after the pandemic, whether online training will replace offline training, how to organize training faculty teams, how to build institute-academy collaborative training mechanisms, how to position subject librarians, and how to carry out promotion and publicity. In October 2020, the authors conducted a targeted opinion survey on experts engaged in information literacy education at both academy and institute levels using questionnaires to propose corresponding development strategies for information literacy education for frontline researchers under the new situation. The questionnaire was distributed online through Wenjuanxing, with 56 experts from the CAS library and information system participating in the survey, including 22 experts from the academy-level and regional libraries and 34 experts from institute-level libraries and the University of Chinese Academy of Sciences Library. All questionnaires were verified as authentic and valid.

4.1 Information Literacy Training Content Needs and Strategies

The survey found that experts generally agreed that diversified training content should be provided, in order of priority: tool software (95%), information retrieval skills (93%), intelligence analysis (88%), library resource services (86%), database usage (86%), writing and submission (84%), data management (82%), patents and intellectual property (77%), research methods (70%), academic ethics and norms (70%), and reading promotion (48%). Some experts suggested further expanding the breadth of training content, believing that "all content related to scientific research information collection, utilization, and management that can effectively support research can be included." Specific suggestions included incorporating "research topic selection," "literature reading methods," "thesis writing," "defense PPT production," "scientific research graphics," "statistical analysis," "project application and management," and "promotion of professional classics and frontier works."

We plan to make the following improvements in training content design: (1) Strengthen systematic curriculum planning, further subdividing course content from perspectives such as discipline specialty, demand type, and difficulty level, balancing universal and personalized needs; (2) Produce short video courses for specific problems, enabling research users to learn targeted content using fragmented time; (3) Strengthen training effectiveness evaluation and user feedback, setting up concise questionnaires after training to timely understand users'

feelings and suggestions about training content, continuously optimizing and expanding training content.

4.2 Information Literacy Training Format Needs and Strategies

The survey found that experts generally recognized the effectiveness of online training and agreed with a combination of online and offline training formats. Forty-eight percent of experts supported online training as the main form supplemented by on-site training; 36% supported on-site training as the main form supplemented by online training; 7% believed that online training alone could meet training needs; notably, no expert (0%) believed that offline training alone could meet training needs; 9% provided specific suggestions on training formats, believing that "on-site training and online training should be combined, with the choice of which to prioritize depending on different conditions."

We plan to make the following arrangements in training format design: (1) Increase the cultivation of online courses, improve the construction of online training institutional norms, and give full play to the main position role of the "CAS Research Information Literacy Lecture Hall" in radiating to the entire academy; (2) Persist in conducting embedded offline training in frontline, flexibly combining training content according to specific needs of research users.

4.3 Information Literacy Training Faculty Needs and Strategies

Regarding the construction of training faculty teams, experts unanimously agreed that library staff from the Library (100%) should be included in the training faculty team, fully affirming the training capabilities and roles of Library staff. In addition, they believed that database vendors and service providers (93%), in-house experts (89%), external experts (80%), publishing editors (73%), institute library staff and University of Chinese Academy of Sciences library staff (73%), and experienced graduate students (55%) should also be included in the faculty team.

We plan to strengthen faculty team construction from two aspects: (1) Hold capacity-building training activities, increase the cultivation of young faculty, and help more young colleagues join; (2) Open the training faculty selection mechanism, such as allowing users to recommend training speakers and self-recommend to become training speakers, widely attracting various experts and senior users throughout the scientific research innovation process to join the faculty team.

4.4 Information Literacy Training Mechanism Construction Strategies

The survey showed that experts generally hoped to participate in the all-institute joint information literacy training service in some way: 79% were willing to participate as training promoters, 64% hoped to participate as training teachers, 64% were willing to participate by feeding back research

users' training needs, 50% hoped to participate as expert group members in training system design and providing consulting suggestions, and 46% hoped to participate as training organizers.

We will consider taking the following measures to strengthen the institute-academy collaborative training mechanism: (1) Establish institute-academy collaborative projects to incentivize the enthusiasm of participating units; (2) Incentivize the enthusiasm of lecturers, promoters, and organizers through rewards or certificates; (3) Utilize training exchange platforms to promote efficient sharing of training information and multi-party win-win cooperation.

4.5 Subject Librarian Role Positioning Strategies

Regarding the positioning and role of Library subject librarians in training services, 82% of experts believed that general methods and tools could be taught online by unified faculty, while subject librarians could better conduct case demonstrations for specific fields or specific problems; 79% supported subject librarians providing online consultation and counseling or establishing WeChat training groups for timely Q&A; 75% believed subject librarians should assist corresponding institutes in training planning; 68% believed subject librarians should conduct regular on-site training to answer user questions face-to-face; 57% believed subject librarians should be responsible for or assist corresponding institutes in training organization work.

In the work of information literacy training for frontline researchers, Library subject librarians will continue to play a core role, including: (1) Collaborating with institute-level librarians to jointly conduct user demand collection, training content planning, training resource matching, and training promotion and publicity for responsible institutes; (2) Focusing on mining and analyzing personalized training needs of responsible institutes.

4.6 Information Literacy Training Promotion Strategies

Survey results on training course promotion methods showed that 77% of experts supported pushing through Official Accounts, 75% supported releasing messages in WeChat groups, 52% supported email notification, and some experts additionally suggested pushing through multiple channels such as institute internal business platforms and QQ groups. The survey also found that experts unanimously (100%) supported providing a link to the "CAS Research Information Literacy Lecture Hall" website on institute library homepages, 73% supported setting up a dedicated information literacy training column on institute library homepages, and 66% supported publishing course previews in institute library homepage announcement boards. Some experts suggested "targeted integration according to each institute's actual situation," "posting creative advertisements in institutes," and "strengthening cooperation and publicity with institute graduate schools."

We plan to make the following attempts in training promotion: (1) Encourage all-institute libraries to strengthen the construction of training publicity systems, such as giving recognition to units with high user participation; (2) Explore counting information literacy education and training learning toward users' continuing education hours to incentivize users' autonomous learning enthusiasm.

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5 Summary and Outlook

After more than ten years of deep cultivation, the Library's information literacy education for frontline researchers in institutes has formed a training service mechanism, training faculty team, training content system, training service platform, training service forms, and training publicity channels with CAS characteristics, basically meeting the needs of CAS researchers and graduate students for information literacy capability enhancement, and receiving widespread recognition and praise from research users. Users have given enthusiastic feedback, describing training lectures as "timely rain" and "gas stations," evaluating them as "very useful," "solving information search difficulties," "greatly helping paper writing," and "enhancing research efficiency." Particularly since the pandemic, the online live training of the "CAS Information Literacy Lecture Hall" has been widely welcomed by research users, promoting the further high-quality and efficient transformation and upgrading of the Library's information literacy education and training for frontline researchers.

The COVID-19 pandemic has brought about a global educational technology revolution and has triggered our in-depth thinking about the future development direction and positioning of information literacy education for frontline researchers during and after the pandemic. Based on fully surveying expert opinions from both academy and institute levels throughout the CAS library and information system, and analyzing the changing needs of information literacy education for frontline researchers during and after the pandemic, this paper proposes corresponding development strategies for the Library in terms of training content, training formats, training faculty, training mechanisms, subject librarian positioning, and training promotion and publicity.

Looking to the future, research information literacy education for frontline researchers will continue to serve CAS institute research users, grasp the essence of information literacy itself and the trends in integrating big data, artificial intelligence, and other advanced technologies and development environments, deeply explore personalized scientific research information needs of users in different fields, types, and stages, and expand the content system of scientific research information literacy education and training. Specifically, we must first form a long-term mechanism for real-time communication of scientific research information literacy education and training needs, understanding, analyzing, and responding to needs in a timely manner through subject librarians' service

mechanisms and information communication channels with institutes. Second, we must further stimulate the enthusiasm of the entire CAS library and information system to jointly participate in innovative information literacy education services through effective incentive measures, consolidating the service network for scientific research innovation information literacy education and training throughout the academy and enhancing joint training service capabilities. Third, we must strengthen open cooperation, further enhancing cooperation with publishers, database vendors, in-house and external experts, and senior users, inviting more outstanding faculty to join information literacy education through win-win cooperation mechanisms to jointly promote training capability enhancement. Fourth, we must explore crowdfunding mechanisms to attract more experts and users from all aspects to contribute novel ideas, richer topics, more diverse resources, and more outstanding faculty to scientific research information literacy education, promoting further innovation and development of information literacy education for frontline researchers.

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On the occasion of the 70th anniversary of the National Science Library of Chinese Academy of Sciences and the 14th anniversary of the establishment of the subject service mechanism, we express our sincere gratitude to all leaders and colleagues who have supported and participated in frontline research services, as well as to the pioneers of subject service and information literacy education, Professors Chu Jingli and Zhang Dongrong!

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Author Contributions

Li Ling: Proposed research ideas and framework, wrote the paper;
Liao Qingyun: Assisted in expert opinion survey analysis, participated in paper writing;
Zhao Yajuan: Participated in paper discussion and conclusion revision.

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Keywords: information literacy education; training service; research institute; scientific research users

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