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Construction of Science Popularization Communication System Under the Background of Digital-Intelligent Integration:A Case Study of Zhejiang Province

Xiajing Dai

School of Economics, Jiaxing University , Zhejiang Province ，China

Abstract:
Against the backdrop of digital-intelligent integration driving the digital transformation of science popularization, Zhejiang Province leverages its advantages in digital reform to advance the construction of a science-popularization communication system from four dimensions: institution, platform, content and collaboration, which has effectively improved citizens' scientific literacy. Nevertheless, problems including data barriers, superficial application of intelligent technologies, digital divides and shortage of interdisciplinary science-popularization talents still persist. Accordingly, this paper puts forward countermeasures such as consolidating the data foundation, deepening AI application in science popularization, improving the whole-scenario communication network and cultivating professional talents, so as to provide practical references for the high-quality development of science popularization in Zhejiang.

Keywords: Digital-intelligent integration; Science Popularization Communication system; Zhejiang Province

1 Introduction

Science popularization refers to activities for disseminating scientific and technological knowledge, promoting the scientific spirit, communicating scientific ideas, and advocating scientific methods among the state and society. It serves as a fundamental project for the innovation-driven development strategy. In 2022, the General Office of the Communist Party of China Central Committee and the General Office of the State Council issued Opinions on Further Strengthening Science Popularization in the New Era. The document explicitly proposes placing science popularization on an equally important position as scientific and technological innovation, further advancing information of science popularization, and vigorously developing online science popularization. In 2024, the Science Popularization Law of the People's Republic of China underwent its first revision. It further emphasizes science popularization for new technologies and new knowledge, requiring necessary science-popularization activities when the state deploys major science-and-technology tasks in emerging technological fields. A series of top-level designs indicate that science popularization has risen to a national strategy, with digitization and intelligence as its key development directions.

At present, new-generation information technologies represented by artificial intelligence, big data, cloud computing and block-chain are evolving rapidly. Deep integration of digital and intelligent technologies, namely "digital-intelligent integration", has become a general trend of transformation across economic and social sectors. This trend has profoundly reshaped the modes of information production, dissemination and reception, and generated urgent demands for systematic reconstruction of the science popularization communication system. Traditional science-popularization forms dominated by "exhibition boards plus lectures" and "venues plus activities" can hardly satisfy the public's demands for instant, fragmented and immersive knowledge acquisition. Science popularization communication is undergoing a profound shift from "quantity availability" to "better quality" and "higher accuracy".

Zhejiang is a pioneer province in China's digital reform and the construction of a demonstration zone for common prosperity, boasting advantages in digital-technology industries and institutional innovation. In July 2023, Zhejiang promulgated and implemented the Regulations of Zhejiang Province on Science Popularization, a representative local regulation in China's science-popularization field, which incorporates the digital transformation of science popularization into local legislation and provides an institutional sample for constructing the science popularization communication system. According to the 15th National Sampling Survey on Chinese Citizens' Scientific Literacy conducted by the China Association for Science and Technology, the proportion of Zhejiang citizens with basic scientific literacy reached 20.0 % for the first time in 2025, rising by 6.47 percentage points from 13.53 % in 2020. Ranking first among provincial-level administrative regions and fourth nationwide, Zhejiang has exceeded the target of over 18 % set for the end of the 14th Five-Year Plan period. Crossing the threshold of "20 %" not only tests the overall performance of science-popularization work in Zhejiang, but also validates the improvement of science-popularization efficiency brought by digital-intelligent construction. Against such background, taking Zhejiang Province as a case, this paper systematically investigates practical paths and optimization directions for building the science popularization communication system under digital-intelligent integration, so as to offer references for the high-quality development of science popularization work in the new era.

2 Practical Exploration on the Construction of Science Popularization Communication System in Zhejiang Province

With its first-mover strengths in digital reform and institutional vitality, Zhejiang has blazed a path for systematic construction of science popularization communication under digital-intelligent integration, mainly reflected in explorations at four levels: institution, platform, content and collaboration.

2.1 Institutional Precedence: Top-level Design for Digital Transformation of Science Popularization

Zhejiang has brought science-popularization work onto a track of law-based and standardized governance. Implemented in July 2023, the Regulations of Zhejiang Province on Science Popularization marks Zhejiang's first local regulation targeting science popularization. Article 4 of the Regulations clarifies equal emphasis on science popularization and scientific-technological innovation, requires incorporating science-popularization work into national economic and social development plans and government performance evaluation systems, organizes national scientific-literacy initiatives, and promotes the digital transformation of science popularization. Article 21 further stipulates that the provincial competent department for science and technology shall, together with the Zhejiang Association for Science and Technology, build digital application systems for science popularization

relying on the integrated intelligent public-data platform, boost sharing of high-quality science-popularization resources, and encourage digital and intelligent upgrading of science-popularization facilities. This means that the digital transformation of science popularization is no longer scattered "technical applications", but legally binding institutional arrangements that provide fundamental guidelines for constructing the science popularization communication system.

Zhejiang's incorporation of digital science popularization into legislation is closely linked to its overall digital-reform progress. As a pioneer in digital reform, Zhejiang has built an integrated intelligent public-data platform and a "platform plus brain" governance framework through reforms from "maximum one visit" to digital transformation and comprehensive digital reform, furnishing a unified public-data foundation and institutional environment for digital science popularization. Meanwhile, as a demonstration zone for high-quality development and common prosperity, Zhejiang regards enhancing citizens' scientific literacy as an important measure to narrow group gaps and realize spiritual common prosperity, assigning higher strategic positioning to science-popularization work.

2.2 Platform Support: Integrated Digital Infrastructure for Science Popularization

Guided by institutional arrangements, Zhejiang has constructed a matrix of digital science-popularization platforms connecting provincial, municipal and county-level authorities. The Zhejiang Association for Science and Technology has developed the digital business module "Zheli Science Popularization", delivering targeted services for key groups such as "the elderly and children", and launched signature projects including "Bridging the Digital Divide for Senior Citizens". Continuously optimizing mobile-end applications, the platform serves as a unified provincial entry point for science-popularization resources. It has implemented the "one-pass" interconnection project for Yangtze River Delta science-popularization venues, connected national-level science-popularization education bases, and launched various resources such as high-quality science-popularization courses, micro-lectures and scientific experiments.

Offline science-popularization facilities are undergoing simultaneous digital and intelligent upgrading. Zhejiang has established a science-popularization-venue system centered on 21 science and technology museums and owns 56 science-and-technology museums, forming a crucial backbone for its science-popularization network. Science and technology museums are accelerating intelligent renovation, widely adopting new technologies and forms including AI-powered robot guides, virtual laboratories, online digital exhibition halls and live-streamed explanations, shifting science-popularization experience from "visiting exhibitions" toward "immersive comprehension". A three-dimensional communication pattern featuring integration of online-offline resources and interconnection of facilities and platforms has taken initial shape.

2.3 Content Innovation: Science Popularization for New-quality Productive Forces and Supply of Digital-intelligent Content

Content supply constitutes the core link of the science popularization communication system. Zhejiang takes the lead nationwide in conducting science popularization for new-quality productive forces, deploying science-popularization resources focusing on cutting-edge fields such as artificial intelligence, new energy, biomedicine and marine science and technology. At present, Zhejiang has set up 114 experience halls for science popularization of new-quality productive forces (including 27 artificial-intelligence-oriented halls), and built 161 sites for science popularization of new-quality productive forces covering intelligent manufacturing, low-altitude economy, medical devices and future industries. These venues aim to build tangible science-and-technology-experience spaces that enable the

public to directly perceive cutting-edge scientific and technological achievements.

In terms of content forms, Zhejiang conforms to digital-intelligent communication trends and promotes deep integration of AI, AR, VR, MR and other digital technologies with science-popularization content production. It explores the application of generative artificial intelligence in science-popularization videos, digital-human explanations and interactive exhibits to enrich the expressiveness and appeal of science-popularization products. Through combination innovation of "cutting-edge content plus digital-intelligent forms", science popularization communication better responds to public concerns over scientific-technological hot spots and future industries.

2.4 Collaborative Engagement: Supply-demand Matching and a Large-scale Science-popularization Pattern for Whole-society Participation

Digital-intelligent integration has also reshaped organizational modes and participation mechanisms for science popularization. Relying on digital platforms, Zhejiang promotes precise matching between science-popularization supply and public demands. Cities such as Quzhou have explored the science-popularization-service model of "public submitting requests — Association for Science and Technology assigning tasks — experts undertaking services". Realizing supply-demand docking through online-offline integration, this model has delivered 778 events benefiting over 180 000 participants, effectively solving the problem of extensive and undifferentiated traditional science popularization.

Meanwhile, Zhejiang endeavors to foster a large-scale science-popularization pattern with whole-society participation. The Regulations of Zhejiang Province on Science Popularization clarifies that science popularization represents a shared responsibility of the whole society, promoting multi-subject collaboration among governments, research institutions, universities, enterprises, media and the public. In 2026, Zhejiang released Zhejiang Science Popularization Blue Book (2025), its first blue book on science popularization. It systematically reviews the progress of science-popularization undertakings across the province and provides a basis for scientific assessment and continuous improvement.

3 Deficiencies of the Science Popularization Communication System in Zhejiang Under Digital-intelligent Integration

3.1 Unbroken Barriers to Resource Data and Insufficient Integration

The "Four-Initiative" Special Action for Digital Science Popularization sets the goal of building a unified science-popularization-resource database. Nevertheless, resources from different authorities and administrative levels are developed separately with inconsistent standards and insufficient inter-connectivity. Departments of science-technology, education, health, meteorology, emergency management and other agencies possess abundant high-quality science-popularization resources, yet unified data standards, metadata specifications and open interfaces remain absent. Coexistence of duplicated construction and hindered resource sharing prevents the unified-resource database from giving full play to its integrated effects. Mechanisms governing cross-platform data right confirmation, benefit distribution and security management also need clarification.

3.2 Superficial Application of Intelligent Technologies: More Digitalization than Intellectualization

The digital transformation of science popularization in Zhejiang generally stays at the level of putting content and activities online. Artificial intelligence is mostly used as auxiliary tools such as intelligent Q&A and subtitle generation. In-depth applications including personalized recommendation based on user portraits, knowledge-graph-driven science-popularization content organization, and large-scale

content production empowered by AIGC remain limited. Immersive experiences supported by virtual simulation and digital twin in science-popularization venues cannot fully satisfy growing experience demands of the public, especially teenagers. In addition, systematic countermeasures are lacking to address tensions caused by algorithm-driven information cocoons and the phenomenon that high-quality science-popularization content gains acclaim yet attracts limited views.

3.3 Persistent Digital Divides Among Different Groups and Regions

While improving science-popularization efficiency, digital-intelligent integration may amplify inequalities. Disadvantages of elderly residents, rural populations and low-income groups in smart-terminal proficiency, network-access quality and digital literacy place them in disadvantaged positions within algorithm-driven science-popularization distribution systems, exposing them to risks of "invisible science popularization". Despite notable outcomes of the "Bridging the Digital Divide for Senior Citizens" special initiative, inclusive and regular digital-feedback mechanisms have not been fully established. Moreover, obvious gaps in science-popularization-resource distribution and communication capacity persist between 26 mountainous counties and developed regions including Hangzhou, Ningbo and Wenzhou. The "last-mile" challenge for grassroots science popularization has not been fundamentally resolved.

3.4 Shortage of Interdisciplinary Science-popularization Talents and Insufficient Vitality of Creation Ecosystem

Digital-intelligent integration calls for interdisciplinary talents equipped with scientific literacy, communication competence and digital skills. However, disciplinary segmentation prevails in current talent-training systems. Scientific-technological workers possess professional scientific knowledge but lack communication skills and media literacy; media practitioners are familiar with traffic logic yet lack capacities for scientific quality control; creators mastering new technologies such as AIGC often lack endorsement from the scientific community. Systems for chief science-communication experts and professional-title evaluation for science-popularization practitioners are still in the initial stage. Incentives to absorb emerging-industry talents including young creators and online science-popularization influencers remain inadequate, restricting large-scale production of high-quality original Zhejiang-branded science-popularization works.

4 Optimization Paths for the Science Popularization Communication System Under Digital-intelligent Integration

4.1 Construct an Integrated Science-popularization Data-resource System to Consolidate Digital Foundations

Implementing requirements of the Regulations of Zhejiang Province on Science Popularization for establishing a provincial unified science-popularization-resource database and digital application systems, this paper proposes advancing the "Three-Unification" project: first, unify data standards by formulating metadata specifications, classification-coding rules and quality-grading standards for science-popularization resources to realize standardized cataloging of multi-modal resources such as texts, images, audios-videos and virtual exhibits; second, unify open platforms. Relying on the provincial integrated intelligent public-data platform, build a science-popularization-resource data middle-platform to promote collection, sharing and orderly opening of science-popularization data from departments of science-technology, education, health and emergency management, and define rules for data right confirmation and security management; third, unify service portals. Develop the one-stop

public entry “Zhejiang Smart Science Popularization”, integrating functions such as venue reservation, event registration, online courses and intelligent Q&A, and form a service closed-loop of “science-popularization map + cloud-based science-popularization classrooms + science-popularization resource mall”.

4.2 Deepen Artificial-intelligence Application to Boost Intelligent Upgrade of Communication

First, promote intelligent content production. Under scientific quality control, encourage science-popularization institutions to adopt generative artificial intelligence for assisting creation of texts, short videos and animations. Build science-popularization knowledge bases and vertical large-language models targeting key fields to cut costs for producing high-quality content. Second, advance precise distribution. Construct intelligent recommendation systems for science-popularization content based on crowd portraits and scenario labels, formulate communication strategies tailored for key groups including teenagers, the elderly, industrial workers and civil servants, and realize personalized “thousand-people-thousand-styles” science popularization. Third, develop immersive experiences. Support science-and-technology museums and science-popularization bases to renovate exhibitions with virtual reality, digital twin and human-computer interaction technologies, and develop metaverse-based science-popularization spaces and digital-human commentators to enhance fun and interactivity. Fourth, establish algorithm-governance mechanisms to curb spread of pseudoscience caused by information cocoons. Incorporate authoritative science-popularization content into platform information-service systems, and improve mechanisms for intelligent monitoring and collaborative refutation of scientific rumors.

4.3 Expand Whole-scenario Communication Networks and Break Through the “Last Mile” at Grassroots Level

Adhere to the principle of “online integration supplemented by offline guarantees” and build a whole-coverage system of communication scenarios. Online, deepen cooperation with major internet platforms and provincial-municipal-county-level integrated-media centers, strengthen the local implementation matrix of “Science Popularization China” in Zhejiang, cultivate clusters of science-popularization online accounts, and facilitate benign cross-platform circulation of high-quality science-popularization content. Offline, embed science-popularization functions into grassroots positions including rural cultural auditoriums, centers for the New-Era Civilization Practice, Party-mass service centers and community service centers. Maintain accessibility of traditional carriers such as mobile science-and-technology museums and science-popularization mobile vans. Confronting digital divides, regularize and institutionalize the “Bridging the Digital Divide for Senior Citizens” special initiative, promote volunteer-led digital feedback and inter-generational mutual-assistance modes. Meanwhile, retain necessary offline science-popularization services and traditional channels such as radio in remote areas to guarantee inclusive science popularization amid digital-intelligent transformation.

4.4 Cultivate High-quality Science-popularization Teams and Stimulate Vitality of Creation Ecosystem

Implement systems for chief science-communication experts and professional-title evaluation for science-popularization practitioners, extending coverage from institutional agencies to universities, research institutes, enterprises and social-service organizations. Launch support programs for science-popularization creators, foster a cohort of science-popularization influencers and young creators with scientific backgrounds and online-communication competence via topic-funding, traffic support and awards. Incorporate digital literacy and communication skills into continuing-education programs

for scientific-technological workers and training systems for primary-secondary-school science teachers. Explore the establishment of majors or curricula on science communication in universities. Build a digital-management platform for science-popularization volunteers and develop professional teams of scientific-and-technological volunteers, forming a talent pattern characterized by “expert leadership, full-time-and-part-time combination and whole-society participation”.

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