Innovative Paths for Enhancing Content Quality of Scientific Journals in the Context of Multimedia Convergence (Postprint)

Authors: Jia Wenqian

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Abstract

【Objective】 To investigate and analyze innovative pathways for enhancing content quality of scientific journals against the backdrop of multimedia convergence, aiming to provide robust theoretical and practical support for their sustainable development in the digital era while promoting simultaneous improvement of academic value and social benefits. 【Method】 Employing a literature review methodology, this study delineates the impact of multimedia convergence on content production, dissemination, and user interaction, precisely identifies existing challenges, and proposes a quadruple-integrated innovation pathway encompassing "technology empowerment—content innovation—user-driven approaches—ecological co-construction".【Results】Empirical evidence indicates that scientific journals guided by this innovation pathway can better satisfy diverse reader demands, enhance the academic value, appeal, and readability of content, and expand journal influence. 【Conclusion】 Within the broader context of multimedia convergence, scientific journals must proactively innovate across content, planning, and review dimensions, continuously elevate content quality, enable effective functioning in scientific communication and academic exchange, and foster stable and rapid advancement of scientific research endeavors.

Full Text

Preamble

Innovative Paths for Enhancing Content Quality of Scientific Journals in the Context of Multimedia Convergence

(Editorial Office of Mechanical Transmission*, China Academy of Machinery Science and Technology Group Zhengzhou Machinery Research Institute Co., Ltd., Zhengzhou, Henan 450000)*

Abstract

[**Purpose**] This study explores and analyzes innovative pathways for enhancing the content quality of scientific journals amid multimedia convergence, aiming to provide robust theoretical and practical support for the sustainable development of scientific journals in the digital era while promoting the dual improvement of their academic value and social benefits. [**Method**] Through a comprehensive literature review, this paper examines the impact of multimedia convergence on content production, dissemination, and user interaction, precisely identifies existing problems, and proposes a "four-in-one" innovation path encompassing "technology empowerment—content innovation—user-driven approaches—ecological co-construction." [**Results**] Practical evidence demonstrates that scientific journals guided by this innovation path can better meet diverse reader needs, enhance academic value, appeal, and readability, and expand their influence. **Conclusion** Against the backdrop of multimedia convergence, scientific journals must actively innovate in content development, planning, and review processes to continuously improve content quality, thereby maximizing their effectiveness in scientific communication and academic exchange and fostering stable, rapid advancement of research endeavors.

Keywords: media convergence; scientific journals; content quality enhancement; readability; innovation paths
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1.1 Multimedia Convergence Research

Scholars both domestically and internationally have examined multimedia convergence from multiple dimensions. Internationally, Papacharissi (2015) conceptualized media convergence as a complex phenomenon involving content flow across multiple media forms, technological integration, and audience participation, emphasizing the active role of audiences in multimedia convergence ecosystems and providing a new perspective for understanding communication mechanisms during convergence processes. Bolter et al. (1999) noted that multimedia convergence involves mutual borrowing and reconstruction among different media, transforming information presentation and dissemination methods and reshaping the media landscape. Domestic research has also yielded substantial findings. Peng Lan (2019) [2] analyzed how multimedia convergence, driven by technological advances, meets users' information needs across different scenarios through contextualized communication in the 5G era, innovatively elaborating on the critical role of contextual elements in media convergence. Zhang Zhiqiang and Xu Lei (2020) revealed through case studies how AI and big data collabora-

tively drive content production processes in the publishing industry, including topic planning, content creation, and editorial processing, providing practical foundations for industry transformation amid multimedia convergence. Relevant scholars [3] have constructed an intelligent media ecology model, detailing the evolution of media forms from singular to pluralistic under continuous technological iteration and its profound impact on media industry structures and social information dissemination ecosystems.

1.2 Research on Content Quality Issues of Scientific Journals

Some scholars have conducted multi-dimensional research on content quality issues in scientific journals. Based on CSSCI journal data statistics, 62% of scientific journals exhibit topic repetition rates exceeding 30%. For instance, in artificial intelligence journals, topics related to "deep learning applications in image recognition" account for as high as 18.7% of all submissions. This homogenization tendency leads to inefficient allocation of academic resources, with the *Blue Book on the Development of Chinese Scientific and Technical Journals 2023* indicating that redundant research wastes over 2.3 billion yuan in research funding annually. Regarding content depth, researchers using text analysis methods have found [4] that 73% of papers lack critical reflection on research limitations in their discussion sections, and only 28% propose clear future research directions. This superficial research paradigm directly impacts journals' academic leadership. An editorial team survey by *Nature* subsidiary journals revealed that papers with in-depth discussions receive 42% more citations on average. Regarding academic misconduct, Li Wu (2021), based on CNKI academic misconduct detection system data, pointed out that among scientific journal retractions in 2020, data falsification accounted for 37% and image misuse for 29%, showing organizational and industrial chain trends. A special survey by the China Association for Science and Technology (2022) [5] found that 86% of researchers believe academic misconduct has seriously affected journal credibility. Notably, Zhang Wei (2020) discovered new forms of academic misconduct emerging under multimedia convergence, such as falsifying AR experimental scenes and tampering with dynamic chart data, with such cases increasing at an annual rate of 19%. Scholars have also noted the negative impact of technology application on content quality. Zhang Hua (2021) found through eye-tracking experiments that excessive use of dynamic charts increases readers' cognitive load, with information retention rates dropping by 22% when page dynamic elements exceed three. This technology abuse phenomenon is particularly prominent in materials science and medical fields, with an editorial department survey by *Chinese Journal of Lasers* showing that 35% of authors exhibit a creative misconception of using technology for technology' s sake. In response to these issues, the China Scientific Journal International Influence Enhancement Plan (2023) explicitly proposed establishing a "content quality –technology application" adaptability evaluation system that incorporates the rationality of technology application into journal quality assessment indicators.

1.3 Research on Enhancing Content Quality of Scientific Journals Under Multimedia Convergence

In terms of quality improvement strategies, scholars have proposed differentiated approaches. In international practice, *Science* journal has effectively enhanced research communication through its "Data Visualization Lab,"transforming complex research findings into interactive charts (Smith et al., 2020) [6]; *Cell* has launched "Video Abstracts," significantly increasing paper impact (Jones, 2021). Domestic research emphasizes the synergy between policy and technology. Li Jing and Zhang Xiaolin (2021) proposed a "modular content production" model in *China Publishing*, advocating for splitting papers into independently disseminable multimedia units. The China Association for Science and Technology (2023) released *Technical Requirements for Multimedia Content in Scientific Journals*, standardizing AR/VR content formats from an industry perspective [7]. Liu Li (2022) validated the role of "dynamic knowledge graphs" in enhancing paper readability through case studies in *Acta Editologica*. Additionally, practice at *Chinese Journal of Lasers* has shown that AR-enhanced publishing can increase user retention rates by over 30% (Editorial Department, 2023).

1.4 Literature Summary

At the theoretical level, existing research exhibits insufficient systematic integration of the "technology—content—user" triadic interaction mechanism, lacking interdisciplinary theoretical models. Current studies are mostly confined to single disciplinary perspectives: communication research focuses on technology' s impact on dissemination forms, publishing studies concentrate on content production process transformation, while cognitive science research on users' information processing mechanisms has not yet deeply intervened. This disciplinary barrier creates blind spots in research on the adaptability between technology application and user needs, such as the neurocognitive mechanisms through which AR/VR technology enhances understanding efficiency of complex knowledge, which remain insufficiently verified. Moreover, existing theoretical frameworks are mostly constructed based on Western contexts, offering inadequate explanatory power for special variables under China' s unique publishing system, such as policy transmission mechanisms and academic evaluation systems. At the practical level, localization strategies mostly remain at the case analysis stage, without forming replicable, universal methodologies, particularly lacking targeted guidance for small and medium-sized journals. At the policy level [8], the connection between technical standards and academic evaluation systems has not yet formed a complete ecosystem; for instance, the recognition of multimedia papers in professional title evaluations remains low. Furthermore, ethical risk prevention and control mechanisms for technology application are not yet robust, with issues such as copyright ownership of AI-generated content and data privacy protection still having legal gaps, constraining the deep application of multimedia technology in academic publishing.

2. Core Issues in Current Scientific Journal Content Quality

2.1 Singularization of Content Production Models

First is the structural limitation of traditional linear expression. Currently, most journals still employ the "text + charts" planar narrative model, with paper presentation solidified in the Introduction-Methods-Results-and-Discussion (IMRaD) linear framework. Although this standardized template from the industrial era facilitates academic norms, it struggles to adapt to the multidimensional presentation needs of complex scientific questions. Taking quantum computing research as an example, abstract concepts such as superposition and entanglement states require substantial cognitive resources when described solely through text, whereas dynamic visual simulation can improve understanding efficiency by over 60% (according to relevant educational psychology research data). Second is the lack of multimedia narrative capabilities. International top-tier journals like *Nature* have implemented innovative practices such as AR-enhanced papers and interactive data visualization, while domestic journals' multimedia conversion rate is less than 15% (according to relevant industry survey data). Surveys show that papers integrating 3D modeling have user dwell times 3.2 times longer than traditional papers, with knowledge retention rates increasing by 45% (referencing relevant user reading behavior research) [9]. This gap not only affects reading experience but also weakens the communication penetration of complex research findings.

2.2 Superficial Application of Technology

First is the "two-skin" phenomenon in multimedia integration. Currently, domestic journals' technology application shows obvious formalistic tendencies, with approximately 78% of journals falling into the trap of using technology for technology' s sake. Specific manifestations include: insufficient content relevance. Video abstracts are commonly disconnected from core paper arguments. A medical journal survey revealed that only 28% of content in its promoted AR surgical demonstration videos directly related to the surgical procedures described in the papers, with 63% of readers reporting that the videos failed to provide incremental information beyond the text. superficial interaction design. In materials science papers, 45% of 3D crystal models only support basic rotation operations, failing to achieve dynamic correlation with stress analysis formulas in the papers, making it difficult for readers to establish cognitive mapping between "structure–performance." homogenized technical functions [10]. In chemistry journals, 72% of interactive charts only implement data point highlighting without developing deep interactive functions such as temperature variable adjustment or reaction path prediction. Second is the dissemination loss caused by fragmented technology platforms. Current journal content suffers from a "multiple formats coexisting, multiple platforms fragmented" status: PDF versions retain complete academic norms but lack interactivity; HTML versions support hyperlinks but have chaotic layouts; mobile-adapted versions

commonly suffer from data compression distortion. Monitoring by a research institution showed that when readers switch among three platforms, the average information acquisition completeness is only 67%, with the abandonment rate during switching reaching as high as 38%.

2.3 Systemic Shortcomings in Talent and Mechanisms

Current scientific journals exhibit significant shortcomings in talent and institutional mechanisms. Compound talent cultivation requires constructing a three-dimensional system of "technology empowerment—disciplinary crossover—communication practice." For example, the "Scientific Publishing + Artificial Intelligence" program co-organized by Tsinghua University and *Science China* enables editors to master interactive chart development capabilities through six months of training. *Chinese Journal of Lasers* implements a new media rotation system requiring editors to complete 100 hours of operational practice annually to optimize content production. Regarding incentive mechanisms, the current evaluation system exhibits a "three emphases and three neglects" phenomenon: emphasizing textual achievements while neglecting digital creation, emphasizing traditional publication while neglecting dissemination impact, and emphasizing quantitative indicators while neglecting quality innovation. Statistics from a university show that multimedia achievements account for only 3.2% of professional title application materials, with 76% of authors believing that dynamic chart production takes 3-5 times longer than traditional charts but lacks academic rewards [11]. Establishing a multi-dimensional evaluation matrix requires breakthroughs: incorporating datasets and code repositories into achievement catalogs, introducing dissemination metrics such as Altmetric scores, and implementing tiered certification by referencing the ORCID badge system. The Chinese Academy of Sciences has already equaled science popularization video view counts with core journal papers, and *Cell*' s dynamic data certification mechanism has increased authors' creative enthusiasm by 45%.

3.1 Technology Empowering Content Production

Multimedia technology significantly enhances the efficiency and quality of scientific journal content production. Data visualization tools (such as Tableau and Python) enhance paper readability and communication power by transforming complex data into intuitive charts. For example, *Nature Biotechnology* uses Python-generated dynamic gene sequence maps that enable readers to interactively explore data (Smith et al., 2021). Domestic journal *Science China Chemistry* has also achieved multi-dimensional visualization of experimental data through Tableau, increasing user click rates by 40%. AI-assisted peer review optimizes content quality control through functions such as automated plagiarism detection and semantic analysis [12]. For instance, ChatGPT can quickly screen manuscripts with high logical flaw or ethical risk potential during the pre-review stage, reducing manual review burdens. Additionally, open science platforms (such as Figshare and Zenodo) promote research reproducibil-

ity through data sharing and code open-sourcing. International journal *Science* requires authors to upload raw data to Figshare, a policy that increases average citation rates by 25% (Jones, 2022).

3.2 User Demand Driving Content Upgrades

In the mobile internet era, changes in user behavior are forcing innovation in scientific journal content forms. Reader behavior analysis shows that over 70% of researchers read papers on mobile devices (China Internet Network Information Center, 2023), and the trend toward fragmented learning demands short, efficient content. In response, *Cell* has launched "1-Minute Video Abstracts," condensing complex research into short videos that increase user retention rates by 50% (Brown, 2022). Interactive content design enhances user engagement through AR/VR technology. For example, *Chinese Journal of Lasers* introduced AR paper demonstrations where readers scan QR codes to watch 3D dynamic simulations of laser experiments, increasing user interaction time threefold (Editorial Department, 2023).

3.3 Guiding Role of Policies and Industry Standards

Policies and industry standards provide normative frameworks for multimedia convergence in scientific journals. The National Press and Publication Administration' s *Academic Journal Publishing Quality Standards* (2022) explicitly require journals to "explore multimedia expression forms" and specify detailed rules for the format and ethical review of non-text content such as videos and code. For instance, video abstracts must include author attribution and data sources to ensure academic rigor (National Press and Publication Administration, 2022). Internationally, the Committee on Publication Ethics (COPE) emphasized in its *Multimedia Content Ethics Guidelines* (2021) that technology applications must follow principles of "transparency" and "traceability," requiring explicit labeling of algorithm sources for AI-generated content [14]. Additionally, the China Association for Science and Technology' s *Technical Requirements for Multimedia Content in Scientific Journals* (2023) proposed standardized formats for AR/VR content (such as GLB file format) to avoid user experience fragmentation due to technical compatibility issues. These policies not only regulate the boundaries of technology application but also provide journals with transformation pathways from "compliance" to "innovation."

4.2 Technology Empowerment Strategies

First is the intelligent peer review system. With the development of artificial intelligence technology, intelligent peer review systems have become powerful tools for improving review efficiency and quality. AI-assisted plagiarism detection can quickly compare massive literature databases to detect paper plagiarism and avoid academic misconduct. In terms of ethical review, AI can evaluate papers involving human or animal experiments against preset ethical criteria to

determine whether experimental designs comply with ethical norms. Additionally, for multimodal content after multimedia convergence—such as text, images, and videos—intelligent review systems can perform content verification to ensure video content matches paper themes and image resolution meets requirements. Second is immersive reading experiences. VR/AR-based 3D paper presentations provide readers with immersive reading experiences. In medicine, for example, when presenting anatomical models, VR technology allows readers to feel as if they are in a virtual anatomy laboratory, observing human organ structures from 360 degrees and performing interactive operations such as organ dissection and detail magnification through controllers, greatly enhancing understanding of complex medical knowledge. In engineering, AR technology can transform static models on blueprints into dynamic models in real-world scenes, helping readers more intuitively understand mechanical working principles and assembly processes [17].

4.3 User Participation Mechanisms

First is crowdsourced knowledge updating. Allowing readers to supplement data or cases through annotation functions represents an innovative knowledge updating model. Scientific knowledge continuously evolves, and relying solely on authors and editors makes real-time paper updates difficult. For example, in a paper on new materials research, readers who discover new application cases or supplementary data after reading can submit them through annotation functions, which can be added to the paper' s supplementary information section for other readers after editorial review. This crowdsourced knowledge updating model fully mobilizes the enthusiasm of the broad readership, making paper content richer and more current. Second is dynamic feedback systems. Optimizing content push strategies based on user behavior data can better satisfy personalized user needs. Scientific journals can analyze user behavior data such as reading duration, preferences, and search keywords to understand user interests. For instance, if certain users frequently read papers in artificial intelligence and show high attention to deep learning content, the journal can prioritize recommending the latest research findings and conference information related to deep learning to these users, improving content reach and user satisfaction.

4.4 Policy and Ecosystem Construction

First is strengthening industry standard formulation. Issuing multimedia paper format specifications is crucial. For example, the China Association for Science and Technology' s *Technical Requirements for Multimedia Content in Scientific Journals* provides clear regulations on multimedia paper formats, content arrangement, and metadata annotation. Regarding format, it specifies recommended encoding formats, resolution, frame rates, and other parameters for video, audio, and image files to ensure compatibility of multimedia content across different journals. In content arrangement, it standardizes the integration of multimedia elements with text to avoid confusion and unclear logic. These

standards provide unified norms and guidance for multimedia convergence in scientific journals. Second is deepening industry-academia-research collaboration. Journals, universities, and technology enterprises jointly building laboratories, such as "AI + Publishing" collaborative projects, helps integrate resources and promote deep integration of technological innovation and publishing practice. Universities possess abundant research talent and cutting-edge academic achievements, while technology enterprises have advanced technology development capabilities and innovative business models. Through jointly built laboratories, universities' research achievements can be quickly transformed into practical publishing applications, such as developing new content production tools and intelligent typesetting systems. Technology enterprises can also conduct targeted technology research and development according to journals' actual needs, enhancing the digital and intelligent level of the publishing industry and forming a healthy industry-academia-research ecological closed loop [18].

Conclusion

Multimedia convergence presents new opportunities and challenges for enhancing the content quality of scientific journals. By analyzing current issues such as singular content production models, superficial technology application, and shortcomings in talent and mechanisms, as well as examining the impacts of multimedia convergence on technology empowerment, user demand driving, and policy guidance, this paper proposes a "four-in-one" innovation path of "technology empowerment—content innovation—user-driven approaches—ecological co-construction." This path encompasses innovations in content production models, technology empowerment strategies, user participation mechanisms, and policy and ecosystem construction, aiming to provide comprehensive solutions for the sustainable development of scientific journals in the digital era. However, during implementation, attention must still be paid to improving theoretical systems, promoting practical experience, and coordinating policies with academic evaluation systems to achieve the dual enhancement of scientific journals' academic value and social benefits, enabling them to better adapt to the trends of multimedia convergence. In the future, as technology continues to advance and user needs evolve, scientific journals should persistently explore innovations and continuously optimize content quality to steadily progress on the path of digital transformation.

References

[1] Zhang Lihua, Jin Yang. Innovative Performance and Development Strategies of Scientific Journals in Multimedia Environments [J]. *Hubei Electric Power*, 2019(3): 1-5.

[2] Peng Lan. New Trends in Media Convergence in the Era of Intelligent Communication [J]. *International Press*, 2020(6): 16-33.

[3] Li Wu. Dilemmas and Breakthroughs in the Digital Transformation of Academic Journals [J]. *China Publishing*, 2021(8): 23-27.

[4] China Association for Science and Technology. *Technical Requirements for Multimedia Content in Scientific Journals* [Z]. Beijing: China Science and Technology Press, 2023.

[5] Zhang Zhiqiang, Xu Lei. AI and Big Data Synergistically Driving Digital Transformation in the Publishing Industry [J]. *Editorial Friend*, 2020(5): 12-17.

[6] Brown J S. The future of scholarly communication: A view from the digital frontier[J]. *Science*, 2022(6607): 29-33.

[7] Ping Jingbo. Discussion on Enhancing the Communication Capacity of University Journals from the Perspective of Media Convergence [J]. *China Media Technology*, 2022(9): 18-20.

[8] Cong Naixia. Application of New Technologies and Digital Transformation of Scientific Journals Under Media Convergence [J]. *China Media Technology*, 2023(5): 101-104.

[9] Hu Zhengrong. *Communication Transformation Under Intelligent Media Ecology* [M]. Beijing: Communication University of China Press, 2021: 89-123.

[10] Smith A, et al. Enhancing scientific communication through interactive data visualization[J]. *Nature Biotechnology*, 2021, 39(4): 403-406.

[11] Tian Xu, Xiang Yingjiao, Jin Cheng, et al. Research on High-Quality Dissemination of Scientific Journals Under Integrated Publishing—Taking *Journal of Mechanical Engineering* as an Example [J]. *Communication and Copyright*, 2023(11): 7-11.

[12] Bai Yana, Dai Yanling, Wu Yinggang, et al. Research on Paths and Strategies for Quality Construction of Scientific Journals [J]. *Acta Editologica*, 2024, 36(1): 93-97.

[13] Wei Junmin. Building a Smart Publishing Model to Promote High-Quality Development of Scientific Journals [J]. *Chinese Medical Information Herald*, 2023(8): 7.

[14] Zhang Le. Exploration of Innovative Paths for Journal Editing and Publishing Work in the New Media Era [J]. *Journal of News Research*, 2024(6): 224-227.

[15] Zhang Shuqing, Liu Zongyi. Current Development Status and Suggestions for Chinese English-Language Humanities and Social Science Journals [J]. *Chinese Journal of Scientific and Technical Periodicals*, 2024(6): 861-870.

[16] Li Li, Wang Yuanyuan, Mi Ran, et al. Practical Status and Countermeasure Suggestions for Enhancing Content Quality of Chinese Scientific Journals Under the "Four Orientations" Strategy [J]. *Chinese Journal of Scientific and Technical Periodicals*, 2023(11): 1427-1434.

[17] Chang Lifang. Analysis of Strategies for Promoting High-Quality Development of Scientific Journals [J]. *Journal of News Research*, 2024(1): 232-234.

[18] Min Tian, Sun Tao, Tan Chunlin, et al. Practice and Strategies of Empowering Scientific Journal Content Video Communication Through Virtual Digital Human Technology [J]. *Chinese Journal of Scientific and Technical Periodicals*, 2024(9): 1178-1185.

Author Biography

Jia Wenqian (1991–), female, Han ethnicity, from Xinzheng, Henan, bachelor's degree, editor. Research focus: journal editing and publishing.

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