

Practice of Peer Review in Academic Journals: A Case Study of Nuclear Science and Techniques (Postprint)

Authors: Sun Lihua

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Abstract

To select and publish papers that are innovative, structurally rigorous, and well-written from a large volume of professional academic papers, establishing a scientifically quantified peer review system is critically important. The editorial office of *Nuclear Science and Techniques* has implemented and optimized the journal's peer review system by scoring indicators on review forms and integrating auxiliary tools such as database retrieval into the system, thereby providing quantified evaluation criteria for paper quality and avoiding misjudgment in the review process. Practice has demonstrated that a well-developed peer review system plays a positive role in enhancing journal impact.

Full Text

Academic Journal Peer Review Practice: A Case Study of *Nuclear Science and Techniques*

Abstract: Selecting papers with novel ideas, rigorous structure, and fluent language from a large volume of professional academic submissions requires a scientifically quantifiable peer review system. The editorial office of *Nuclear Science and Techniques* (NST) has implemented the construction and optimization of a journal peer review system. By scoring review form indicators and embedding auxiliary tools such as database retrieval into the system, NST provides quantifiable evaluation criteria for paper quality and avoids misjudgment in reviews. Practice has proven that a well-developed peer review system plays a positive role in enhancing journal impact.

Keywords: Academic journals; Peer review; Optimization

Peer review, characterized by its fairness and merit-based selection, has become the standard method for evaluating academic papers in the international scholarly community. When selecting manuscripts, academic journals typically engage experts working in relevant fields based on the research presented in the papers, utilizing their professional expertise to assess the academic standards and related value of the papers. Revised manuscripts may be sent to the original reviewers for re-review depending on the circumstances.

Researchers serving as Associate Editors (AEs) can ensure scientific and fair judgment. Their role transformation from researcher to journal editor bridges the gap between the journal and research groups. Through participation in journal operations, researchers can gain practical understanding of academic publishing dynamics and technical methods, while the journal can accurately grasp researchers' needs through their feedback. Currently, NST has invited five researchers to serve as AEs to assist with manuscript peer review. While completing high-quality manuscript evaluations, they also recommend the journal to relevant academic circles, expanding its dissemination.

Based on their understanding of the field, AEs can select appropriate peer reviewers for manuscripts while also providing revision guidance according to their own judgment. The system currently offers four types of flag labels, which facilitate user identification for the journal to some extent.

Technical Support for Reviewer Selection

Through the establishment of a peer review platform, scientists have stepped forward as the main actors in journal operation, and the editorial office needs to provide them with technical support. In NST's manuscript submission and review system, we provide AEs with four pathways for selecting reviewers. First, AEs can add appropriate experts based on their own knowledge of the research domain and invite them to review. Second, AEs may use author-suggested reviewers. To ensure fairness, only one author-suggested reviewer can be used per manuscript. Additionally, the system automatically adds a Web of Science literature database link for author-suggested reviewers to verify their credentials using citation databases. Third, we have implemented a Reviewer Locator function that analyzes the metadata and abstract submitted by authors to create a fingerprint document containing the article's main information. This document is then compared with articles in Web of Science to identify similar papers, extract author information, and list corresponding authors as recommended reviewers for AEs to select. Fourth, the system has accumulated substantial submission data, allowing AEs to retrieve information on existing reviewers through keyword searches.

Identity Verification for Reviewer Qualifications

Scholars can be authors, reviewers, or even editorial board members in academic activities. We have integrated ORCID identity authentication into the system

to evaluate reviewers' qualifications through improved personnel information. ORCID (Open Researcher and Contributor ID) is a non-profit organization that addresses systematic researcher name ambiguity in academic literature by assigning unique, persistent identifiers linked to their research outputs. Once researchers register with ORCID and obtain their unique identifier, all subsequent research activities—including publishing articles and applying for grants—can be tagged with their ORCID iD. As ORCID enhances the scientific discovery process and improves funding and collaboration efficiency, it has been widely recognized and promoted by publishing institutions. Currently, ORCID has integrated with Thomson Reuters' ResearchID. Additionally, to enrich personnel information, we have delegated personal information maintenance authority to authors to ensure timely updates, and the journal can also tag reviewers with keywords and labels based on their review performance.

Quantitative Peer Review Form Construction

Customization of Peer Review Forms

Academic papers are scientific records of new research findings, innovative insights, or knowledge on a particular academic topic in experimental, theoretical, or observational aspects; or scientific summaries of new progress made by applying known principles in practice. The value of academic achievements does not depend on whether the field is new, but rather on the depth of the research question—the deeper academic effort and superior insight invested by the researcher that gives the study greater academic weight. Therefore, peer review forms must ensure that selected academic papers present arguments of broad scientific interest, that the evidentiary basis supporting the author's academic viewpoints is accurately used and correctly expressed, and that the article follows proper writing conventions.

The design of peer review forms must satisfy two requirements: facilitating reviewer operation while helping the journal receive instructive review comments. Consequently, NST's peer review form includes two components: a structural comments section and a content comments section.

The structural comments section is presented in table format, requiring reviewers to evaluate manuscript quality from five aspects: paper quality, academic value, correctness of conclusions, readability, and clarity of process presentation, using four rating standards: "Unacceptable," "Fair," "Good," and "Excellent," with the aim of guiding reviewers to pay special attention to the article's innovation and academic value.

The content comments section requires reviewers to provide a decision on whether to accept the manuscript, along with supporting reasons to explain their conclusion and suggestions for addressing any deficiencies. This section is divided into two parts: "Confidential Comments to the Editor" and "Comments to the Author," both set as required fields to ensure reviewers can provide fair and objective opinions with appropriate confidentiality. Reviewers can provide

reasons for acceptance or rejection in the comments to the editor, which are only visible to the editorial office. Comments to authors help guide further improvements in manuscript quality and are returned to authors for their reference.

Quantification of Peer Review Forms

Based on over two years of operational practice at NST, we have found that although reviewers may provide subjective evaluations in the content comments section, they still make objective selections in the structural comments section. To reduce interference from reviewers' subjective factors in manuscript evaluation and ensure objective and fair assessment, it is necessary to quantify the evaluation indicators provided by reviewers, offering a quantitative basis for editorial board decisions. We developed an offline paper evaluation system software using PostgreSQL 9.4 relational database software. According to the options in the current structural evaluation form, we assign percentage values to the four evaluation standards: "Unacceptable" = 5 points, "Fair" = 10 points, "Good" = 15 points, and "Excellent" = 20 points. The combined scores from all five criteria serve as the paper's total score for that evaluation standard. The system uses data tables for score entry, storage, statistics, and retrieval.

We used the database to conduct statistics on the publication status of submissions from 2014 and the citation status of these published papers in 2016. In 2014, NST received 296 submissions, of which 133 were accepted for publication. By May 30, 2016, these published papers had been cited a total of 46 times. The statistical results show that articles scoring above 75 points contributed 56.5% of the citations. Although the sample size is relatively small, it sufficiently demonstrates the point: a minority of excellent articles contribute the majority of journal citations, and the journal's impact indicators are primarily provided by articles scoring above 75 points. The proportion of excellent articles largely determines the journal's influence.

How NST Avoids Misjudgment in Peer Review

Peer review is the optimal pathway for authors to improve paper quality. By incorporating diverse feedback from review experts, the quality of published articles improves significantly compared to the submitted version. Both authors and reviewers should recognize the original intention of this system and adhere to academic norms during the review process. To avoid misjudgment issues in peer review, journals have continuously introduced new technologies to optimize the system, making the review mechanism more robust. NST primarily avoids peer review misjudgment through the following measures: First, the system embeds the CrossCheck plagiarism detection system, which automatically checks submissions for duplication and generates reports, providing reviewers with evidence-based judgment. Second, reviewer selection avoids exclusive reliance on author-suggested reviewers; participating experts must include international reviewers. Third, AEs can score reviewers based on their review quality

and timeliness, with excellent reviewers receiving more opportunities to participate in NST's review process. Fourth, final decisions on manuscript acceptance are made by the editor-in-chief. This multi-layered control makes NST's review system more rigorous and scientific.

Conclusion

A well-developed peer review system is the guarantee of journal quality. To ensure fairness and impartiality in peer review, NST employs a peer review process where researchers conduct reviews and the editor-in-chief makes final decisions. The journal utilizes auxiliary technologies such as academic identity recognition and literature databases to help editorial board members verify reviewer qualifications and address academic ethics issues in submissions. Simultaneously, we have optimized the peer review form by quantifying evaluation indicators, providing reasonable criteria for editorial board decisions. Our next step is to integrate the scoring mechanism into the submission and review system while experimenting with open review methods to further improve the peer review system.

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Author Affiliation: Joint Editorial Office, Shanghai Institute of Applied Physics, Chinese Academy of Sciences

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