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Analysis of the use of artificial intelligence language models in the automation of scientific communication

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Abstract. The relevance *of the study is determined by the rapid integration of AI language models into scientific communication processes, which is accompanied by a transformation of academic interaction formats and increasing requirements for the quality, reliability and integrity of research dissemination. Under conditions of intensification of automated text generation and knowledge exchange, the need arises to develop scientifically grounded approaches to the controlled use of AI in academic environments.* ***The purpose*** *of the article is to substantiate the theoretical and methodological foundations for the application of AI language models in the automation of scientific communication with an emphasis on ensuring the quality, reliability and integrity of research outputs.* ***The research methods*** *are based on theoretical generalization, analysis and synthesis of scientific sources, as well as a logical-analytical approach to interpreting the transformation of communicative processes under AI influence.* ***As a result*** *of the study, the conceptual essence and functional role of AI language models in scientific communication have been clarified, and the main directions of their application in the automation of academic*

interaction and knowledge exchange have been identified. Methodological approaches to evaluating the effectiveness and quality of AI-assisted communication have been substantiated, which include semantic, epistemic and communicative criteria. Key scientific and practical problems have been revealed, in particular semantic distortion, variability of outputs, transformation of authorship and insufficient institutional regulation. It has been proven that effective use of AI tools is ensured through their selective and controlled integration combined with mandatory verification of generated content. ***Conclusions*** *indicate that AI language models function as instruments for optimizing scientific communication processes, provided that methodological control and academic integrity are maintained. Prospects for further research are associated with the development of standardized evaluation models, the identification of measurable indicators of quality and the empirical validation of the effectiveness of AI-assisted scientific communication.*

Keywords: *scholarly communication, academic writing, text automation, epistemic validity, semantic accuracy, academic integrity, scientific editing, information verification.*

Аналіз використання мовних моделей штучного інтелекту для автоматизації наукової комунікації

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Анотація: ***Актуальність дослідження*** *зумовлена інтенсивною інтеграцією мовних моделей штучного інтелекту в процеси наукової комунікації, що супроводжується трансформацією форматів академічної*

взаємодії та підвищенням вимог до якості, надійності й доброчесності поширення результатів досліджень. В умовах зростання обсягів автоматизованого генерування текстів і знань актуалізується потреба у формуванні науково обґрунтованих підходів до контрольованого використання штучного інтелекту в академічному середовищі. ***Метою статті*** *є обґрунтування теоретико-методологічних засад застосування мовних моделей штучного інтелекту для автоматизації наукової комунікації з акцентом на забезпечення якості, надійності та доброчесності результатів дослідження.* ***Методи*** *дослідження ґрунтуються на використанні теоретичного узагальнення, аналізу та синтезу наукових джерел, а також логіко-аналітичного підходу до інтерпретації трансформації комунікативних процесів під впливом штучного інтелекту.* ***У результаті*** *дослідження уточнено сутність і функціональну роль мовних моделей штучного інтелекту в системі наукової комунікації, виявлено основні напрями їх застосування для автоматизації академічної взаємодії та обміну знаннями. Обґрунтовано методичні підходи до оцінювання якості та ефективності комунікації, опосередкованої штучним інтелектом, на основі семантичних, епістемічних і комунікативних критеріїв. Виявлено основні наукові й практичні проблеми, зокрема ризики семантичних спотворень, варіативність результатів, трансформацію авторства та недостатню інституційну регламентацію. Доведено, що ефективність використання штучного інтелекту забезпечується за умови його вибіркової та контрольованої інтеграції з обов'язковою верифікацією згенерованого контенту.* ***Висновки*** *полягають у тому, що мовні моделі штучного інтелекту є інструментом оптимізації процесів наукової комунікації за умови збереження методологічного контролю та академічної доброчесності. Перспективи подальших досліджень пов'язані з розробленням стандартизованих моделей оцінювання, визначенням кількісних індикаторів якості та емпіричною*

перевіркою ефективності використання штучного інтелекту в науковій комунікації.

Ключові слова: *наукова комунікація, академічне письмо, автоматизація тексту, епістемічна валідність, семантична точність, академічна доброчесність, наукове редагування, інформаційна верифікація.*

Problem statement. The rapid integration of Artificial Intelligence (AI) language models into the academic environment is transforming the architecture of scientific communication, yet this transformation unfolds faster than the development of consistent methodological, ethical and institutional frameworks. The problem arises from the growing discrepancy between the technological capacity of AI systems to generate, translate, summarize and structure scholarly texts and the limited understanding of how such interventions affect the epistemic quality, authorship integrity and reliability of scientific knowledge dissemination. In particular, the automation of key communicative processes – including abstract writing, peer-review support, literature synthesis and multilingual adaptation – creates both opportunities for efficiency gains and risks of semantic distortion, hidden bias and erosion of academic accountability.

This issue is directly linked to important scientific tasks related to the redefinition of authorship, validation of AI-assisted outputs and preservation of disciplinary rigor in knowledge production. At the same time, it is closely connected with practical challenges such as ensuring transparency in AI-mediated writing, developing standards for acceptable use in scholarly publishing and aligning automated communication tools with the requirements of international indexing systems and editorial policies. The absence of unified approaches to evaluating the contribution of AI in scientific texts complicates the comparability of research outputs and may weaken trust in academic communication as a whole.

Thus, the core problem lies in the need to theoretically substantiate and practically regulate the use of AI language models as instruments of scientific communication, ensuring that their integration enhances rather than undermines the quality, credibility and reproducibility of research results.

Analysis of recent research and publications. A review of contemporary research on the use of AI language models for automating scientific communication demonstrates the interdisciplinary nature of this field and the gradual formation of an integrated conceptual framework. In particular, K. Novik substantiates the potential of artificial intelligence in creating adaptive learning environments, emphasizing its ability to personalize educational content and, consequently, transform communication among participants in the academic and educational process [1]. Further developing this perspective, K. Novik and co-authors focus on applied aspects of AI use for the automated detection and correction of phonetic errors, demonstrating the capabilities of language models in improving the quality of academic writing [2].

At the same time, S. Yevseiev and co-authors examine the architectural foundations of educational content aggregators with open APIs, which ensure automation of access, processing, and dissemination of scientific information [3]. Ye. Tiahnyriadno and co-authors provide a comparative analysis of distance education models, highlighting the growing role of digital communication tools, including intelligent learning support systems [4]. S. Kocherhina and co-authors investigate the transformation of teaching activities under AI integration, emphasizing changes in formats of scientific interaction and knowledge dissemination [5].

A separate line of research is represented by studies addressing the broader context of AI use in communication processes. K. Kupriienko analyzes the application of AI in digital marketing, focusing on the automation of communication strategies, which has conceptual parallels with scientific communication [6].

I. Suruzhiu and co-authors explore the transformation of integrated marketing communications under the influence of AI, demonstrating its role in personalizing information flows [7]. H. Kalach and co-authors consider AI as a tool for automating management processes and decision-making, which indirectly affects the organization of scientific activity and communication [8].

A significant contribution to the theoretical understanding of scientific communication in the AI era is provided by international scholars. M. Schäfer analyzes the transformation of science communication under the influence of artificial intelligence, emphasizing shifts in authorship and information sources [9]. H. Razack and co-authors justify the use of AI-assisted tools to redefine the global scholarly communication landscape, particularly through the automation of editorial and analytical processes [10].

At the same time, R. Khera and co-authors conduct a comparative analysis of AI-generated and human-written texts, demonstrating the increasing quality and relevance of outputs produced by language models in scientific writing [11]. C. Gauckler and M. Werner examine artificial intelligence as a challenge to traditional mechanisms of scientific communication, highlighting issues of reliability and ethics [12]. T. Mishra and co-authors investigate the scale of large language model adoption in academic publishing, emphasizing their role in accelerating manuscript preparation and peer review processes [13]. S. Tayebi Arasteh and co-authors demonstrate the effectiveness of language models in automating machine learning workflows in clinical research, thereby extending their application in scientific practice [14].

Additionally, H. Zavolodko and co-authors establish a methodological foundation for digital competencies in web technologies, which serves as a prerequisite for the effective use of AI language models in scientific communication processes [15].

Identification of previously unresolved parts of the general problem. Despite the increasing use of AI in scientific communication, key aspects remain insufficiently resolved. There is no integrated conceptual framework that consistently explains the role of AI language models within academic communication systems, while existing studies focus on fragmented functions. Methodological approaches to evaluating AI-assisted texts are also underdeveloped, particularly regarding semantic accuracy, epistemic validity and reproducibility, which is caused by the rapid evolution of technologies and the lag of theoretical generalization.

This necessitates a comprehensive approach that combines conceptual clarification, systematization of application directions and development of evaluation frameworks. Particular importance is attached to addressing semantic distortions, authorship transformation and the lack of regulatory standards. The study focuses on these gaps, as their resolution is essential for ensuring the quality and reliability of AI-assisted scientific communication and for achieving the overall aim of the article.

Formulation of the objectives of the article (task setting). The purpose of the article is to develop a theoretical and methodological basis for the use of AI language models in the automation of scientific communication with a focus on ensuring the quality, reliability and integrity of research dissemination.

Objectives of the article:

1) to clarify the conceptual essence and functional role of AI language models in scientific communication;

2) to substantiate methodological approaches to evaluating the quality and effectiveness of AI-assisted communication;

3) to identify key problems and develop recommendations for the reliable and integrity-based use of AI tools.

Main material. The conceptual essence of AI language models in the system of scientific communication is defined by their ability to process, generate and transform textual information within a probabilistic framework based on large-scale training data, which enables them to perform not only auxiliary but also partially cognitive functions in knowledge dissemination. Functionally, such models act as intermediaries between the author and the audience, restructuring communicative processes through automation of text production, semantic compression, multilingual adaptation and contextual alignment. This shifts scientific communication from a purely human-driven activity to a hybrid format where AI supports the acceleration, standardization and partial formalization of academic discourse, while simultaneously raising questions regarding epistemic reliability and authorship boundaries (table 1).

Table 1

Functional characteristics of AI language models in the system of scientific communication

Component	**Substantive characteristic**	**Key implementation features**	**Functional significance**
Cognitive-analytical	Processing and structuring of scientific information	Text summarization, semantic clustering, literature synthesis	Enhances analytical depth and reduces information overload
Generative	Automated creation of scientific texts and fragments	Abstract writing, drafting sections, paraphrasing	Accelerates preparation of academic outputs
Communicative	Mediation and adaptation of scientific content for different audiences	Simplification, style transformation, audience-oriented rewriting	Expands accessibility and clarity of research results
Translational	Multilingual transformation of academic texts	Machine translation, terminology alignment	Facilitates international dissemination of knowledge

Standardizing	Alignment with formal academic requirements	Formatting, citation structuring, compliance with journal guidelines	Ensures consistency and conformity of scientific texts

Source: developed by the author based on [1, p. 190; 2, c. 212; 10, p. 136; 11, p. 3080; 12, p. 1312].

The outlined functional characteristics operate not in isolation but as interdependent elements embedded in the full cycle of research communication, from idea formalization to publication and post-publication dissemination. Their practical relevance becomes particularly evident in contexts where time constraints, multilingual requirements and increasing publication standards intersect. For example, the cognitive-analytical function is actively employed during literature review, where AI-assisted synthesis allows researchers to identify thematic clusters and conceptual gaps across large corpora of publications, which would otherwise require disproportionately high manual effort [1, p. 190]. This is especially valuable in interdisciplinary studies, where terminological heterogeneity complicates traditional analytical approaches. The generative and standardizing functions are most visibly integrated into manuscript preparation workflows. Researchers use AI to construct initial drafts of abstracts or methodological descriptions, after which these outputs are critically refined to ensure conceptual precision [12, p. 1312]. At the same time, automated alignment with formatting and citation requirements significantly reduces the technical burden associated with submission to indexed journals, particularly those with strict editorial policies. In applied terms, this allows scholars to reallocate effort from formal compliance to substantive content development, which indirectly improves the overall quality of research outputs. The communicative and translational functions demonstrate their effectiveness in expanding the reach of scientific results beyond local academic environments. In practice, AI-mediated adaptation of texts enables non-native English-speaking researchers to present their findings in a linguistically and stylistically appropriate form for international audiences, minimizing distortions in meaning that often arise

in conventional translation processes [11, p. 3080]. This is critically important for ensuring equitable participation in global scientific discourse. However, empirical observations indicate that such transformations require expert validation, as subtle shifts in terminology or argumentation logic may alter the interpretation of results. The interactive function introduces a qualitatively new dimension by supporting iterative refinement of scientific texts in real time. Rather than a linear writing process, researchers increasingly engage in dialogic interaction with AI systems, testing alternative formulations, restructuring arguments and evaluating different modes of presentation. In practical terms, this enhances adaptability and accelerates decision-making during writing, particularly under conditions of tight deadlines or collaborative authorship. At the same time, the combined application of these functions reveals systemic constraints that shape their effective use [10, p. 136]. The benefits of efficiency and standardization are counterbalanced by the need for rigorous expert control, as AI-generated content may exhibit plausible but substantively inaccurate formulations. Therefore, in modern scientific communication, the practical implementation of AI language models should be interpreted not as a replacement of scholarly activity but as a tool for augmenting intellectual work, where the decisive factor remains the researcher's capacity to critically evaluate, contextualize and validate automated outputs.

The application of AI in the automation of academic interaction and knowledge exchange is characterized by a shift from supportive text processing toward the orchestration of complex communicative workflows that integrate creation, evaluation and dissemination of scientific content. Unlike basic functional use, contemporary implementations focus on embedding AI into the infrastructure of scholarly ecosystems, where it mediates interactions between researchers, editors, reviewers and broader audiences. This transformation is reflected in the emergence of platform-based solutions that enable continuous, data-driven exchange of

knowledge, reduce temporal barriers in communication and enhance the scalability of academic collaboration across institutional and geographical boundaries (table 2).

Table 2

Directions and forms of applying AI in the automation of academic interaction and knowledge exchange

Direction of application	**Operational manifestation**	**Applied formats**	**Resulting effect**
Research collaboration support	Coordination and alignment of joint research activities	AI-assisted collaborative writing platforms, shared semantic workspaces	Increased coherence and efficiency of co-authored outputs
Peer-review augmentation	Analytical support of manuscript evaluation processes	Automated screening, reviewer recommendation systems, content consistency checks	Improved speed and objectivity of review procedures
Knowledge dissemination	Expansion of channels and formats for presenting research findings	AI-generated summaries, visual abstracts, adaptive content formats	Broader reach and accessibility of scientific results
Academic networking	Facilitation of connections between researchers and research topics	Intelligent matching systems, recommendation algorithms	Strengthening of interdisciplinary collaboration and knowledge exchange
Educational integration	Inclusion of research outputs into learning environments	AI-driven content adaptation for teaching materials, interactive modules	Acceleration of knowledge transfer between research and education
Post-publication analytics	Monitoring and interpretation of the impact of scientific outputs	Citation tracking, altmetrics analysis, semantic feedback tools	Enhanced understanding of research visibility and influence

Source: developed by the author based on [3, p. 158; 4; 5; 9; 13].

In practice, these directions function as coordinated mechanisms embedded in digital research workflows rather than as isolated tools. In collaborative projects, AI is used to align terminology and argumentation across contributions of different authors, which reduces inconsistencies that typically arise in multi-author papers. For example, during joint manuscript preparation, AI-assisted environments can detect mismatches between sections written by different researchers and suggest unified formulations, allowing teams to maintain conceptual coherence without multiple revision cycles. Within editorial processes, AI operates as a preliminary analytical filter that streamlines peer review. Journals increasingly apply automated checks to verify structure, references and basic logical consistency before manuscripts reach reviewers [13]. In applied terms, this reduces the load on experts and shortens decision timelines, while reviewer recommendation systems help identify specialists whose research focus closely matches the submitted work, improving the quality of feedback. In dissemination, AI enables the transformation of one research output into several communication formats adapted to different audiences. A typical case is when a full article is converted into a concise summary for professional platforms or into structured material for teaching, preserving key findings but adjusting presentation logic [4]. This approach increases the practical reach of research without duplicating effort. AI-driven networking tools also reshape how collaborations emerge. By analyzing thematic proximity rather than formal affiliations, such systems can suggest partnerships between researchers working on related problems from different disciplines, which in practice supports the formation of interdisciplinary teams in areas where traditional academic networks are fragmented.

Overall, these applications demonstrate that AI primarily reduces coordination costs and accelerates knowledge circulation, while its effective use depends on the researcher’s ability to critically validate outputs and adapt them to specific scientific contexts.

The substantiation of methodological approaches to evaluating the effectiveness and quality of AI-assisted scientific communication requires a shift from purely quantitative metrics toward integrated assessment models that capture semantic accuracy, epistemic validity and communicative adequacy. Unlike traditional evaluation of academic outputs, which relies on citation-based indicators or formal compliance, AI-mediated communication demands criteria that reflect the interaction between automated generation and human intellectual control. This involves the operationalization of evaluation dimensions that can detect not only efficiency gains but also potential distortions in meaning, logical coherence and contextual relevance introduced during AI-assisted processing (table 3).

Table 3

Methodological approaches to evaluating the effectiveness and quality of AI-assisted scientific communication

Evaluation dimension	Analytical focus	Measurement instruments	Practical relevance
Semantic accuracy	Consistency of meaning and absence of distortion in AI-assisted texts	Expert validation, semantic similarity indices, cross-text comparison	Ensures preservation of original research intent
Epistemic validity	Alignment of generated content with scientific knowledge and evidence	Source verification, fact-checking protocols, citation consistency analysis	Prevents dissemination of unsupported or misleading claims
Structural coherence	Logical organization and internal consistency of the text	Discourse analysis, argument mapping, cohesion metrics	Supports clarity and interpretability of research outputs
Communicative adequacy	Appropriateness of content for target audience and purpose	Readability assessment, audience adaptation testing, stylistic evaluation	Enhances accessibility without loss of scientific rigor

Efficiency impact	Reduction of time and resources in communication processes	Time tracking, workflow comparison, productivity indicators	Demonstrates practical benefits of AI integration
Reliability of interaction	Stability and reproducibility of AI-assisted outputs under similar conditions	Repeated query testing, output variance analysis	Assesses predictability and trustworthiness of AI tools

Source: developed by the author based on [10, p. 138; 11, p. 3081; 12, p. 1315; 13; 14]

Rather than being applied as a final control procedure, these evaluation approaches are integrated into the writing process at stages where the risk of distortion is highest. In particular, semantic accuracy and epistemic validity are checked in interpretative sections such as conclusions and discussion, where AI-generated formulations may appear logically sound but subtly shift causal relationships or emphasis. In practice, authors compare such fragments with empirical results or cited sources to ensure that meaning is preserved.

Structural coherence and communicative adequacy are refined through iterative editing, especially when the same material is adapted for different formats. For example, a manuscript prepared for a journal and its shortened version for conference proceedings often require different levels of detail, and AI-generated transitions may need correction to avoid fragmentation of argumentation [14]. This makes evaluation not a formal step but a continuous adjustment of textual logic.

Efficiency is typically assessed through direct comparison with conventional workflows. Tasks such as summarizing findings or reorganizing sections are completed faster, particularly in multi-output projects, but this advantage is balanced by the need to verify critical content [11, p. 3081]. Reliability, in turn, is tested through repeated use of similar prompts: if outputs vary significantly, they are treated as provisional drafts rather than final formulations, which has become a practical norm in rigorous academic writing.

The use of AI language models in academic writing and dissemination reveals a range of interconnected scientific and practical problems that directly affect the quality and credibility of research communication. One of the key issues is semantic distortion, when generated text remains formally consistent but subtly shifts meaning, causal links or emphasis, especially in conclusions and interpretation of results [10, p. 138]. This is closely linked to the problem of epistemic validity, as AI can produce plausible yet weakly substantiated statements, which increases the risk of integrating unverified content into scientific discourse.

A separate challenge concerns authorship and responsibility. The involvement of AI complicates the clear attribution of intellectual contribution and accountability for inaccuracies, while the lack of unified disclosure standards leads to inconsistent reporting practices across journals [5]. Methodologically, difficulties arise in evaluating AI-assisted texts, since traditional criteria do not fully capture their hybrid nature, and existing detection tools are not sufficiently reliable. At the same time, reproducibility becomes unstable due to variability of outputs even under similar prompts.

From a practical perspective, dependence on training data introduces risks of bias, outdated information and disciplinary imbalance, which can affect the neutrality of communication. In multilingual contexts, this is reinforced by subtle terminological shifts that may distort scientific precision. Institutional limitations further intensify the problem, as editorial policies, peer-review procedures and university regulations are still adapting to AI integration [9]. Overall, the core tension emerges between increased efficiency and the need to maintain epistemic control, as accelerated text production may lead to reduced critical depth and gradual standardization of academic expression if not properly regulated.

The development of practical recommendations for optimizing the use of AI tools in scientific communication requires a balance between efficiency and epistemic control, where AI is applied as a supportive instrument rather than a source

of knowledge. In practice, its use should be limited to structuring, linguistic refinement and formatting, while interpretation, argumentation and conclusions remain fully under the author's responsibility.

A key condition is the integration of verification procedures into the writing process. AI-generated fragments, especially in analytical sections, should be systematically compared with empirical data and source materials to prevent semantic distortion and unsubstantiated claims. This control is most effective when applied iteratively during text development rather than only at the final stage.

Transparency of AI involvement is essential for maintaining academic integrity. Authors should disclose the use of AI tools and the type of assistance provided, which supports consistency of editorial practices and strengthens trust in research outputs. At the same time, institutional regulation should include clear internal guidelines that define acceptable use and procedures for validating AI-assisted content.

In multilingual and dissemination contexts, expert revision remains necessary to ensure terminological precision and preserve the logic of the study, as automated adaptation may introduce subtle conceptual shifts. Finally, effective application depends on the researcher's ability to critically assess AI outputs, treating them as drafts rather than final results. Thus, optimization is achieved through selective, controlled and methodologically grounded use of AI in scientific communication.

Conclusions. The study has established that the integration of AI language models transforms scientific communication into a hybrid process where automated and human cognitive operations interact, increasing efficiency of text production, adaptation and dissemination, while simultaneously introducing risks related to semantic accuracy and epistemic validity. It has been shown that the effectiveness of AI-assisted communication depends primarily on the level of methodological control embedded in the research process rather than on the intensity of AI use .

The main problems are associated with semantic distortion of generated content, variability of outputs that complicates reproducibility, blurring of authorship and responsibility, and the absence of unified standards for disclosure and evaluation of AI involvement. Additional constraints arise from data bias, terminological shifts in multilingual contexts and insufficient institutional regulation.

It is substantiated that optimization requires controlled and selective use of AI, mandatory verification of generated content, transparency of its application and the development of internal regulatory frameworks.

Prospects for further research are related to the development of standardized evaluation models, identification of measurable quality indicators and empirical assessment of the impact of AI on the reliability and interpretability of scientific results.

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