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Encyclopedic web resources and generative artificial intelligence: a methodological dimension

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Abstract. This article addresses a critical gap in the methodological foundations for designing, operating, and developing encyclopedic web resources in the context of generative artificial intelligence (GenAI) integration. While existing research has examined GenAI's applications in information systems, a systematic framework for preserving epistemic quality in encyclopedic knowledge systems remains underdeveloped. We analyze the transformational impact of GenAI on the structure, functionality, and content of encyclopedic web resources as components of web-oriented automated information systems. We argue that GenAI functions not merely as an automation tool but as a factor fundamentally altering user–knowledge interaction patterns, necessitating reconceptualization of encyclopedic resources as human–machine intelligent systems. The article examines the principal methodological risks of GenAI adoption, with particular emphasis on information reliability degradation and cognitive engagement reduction in knowledge creation processes. These risks, we contend, directly affect the epistemic quality of encyclopedic content and demand specific quality assurance mechanisms. We propose a framework for ensuring epistemic quality structured around five criteria: justification, reliability, accuracy, verifiability, and consistency. Three complementary methodological approaches are outlined: a human-centered approach delineating roles between GenAI and experts; a hybrid approach defining GenAI integration scenarios; and a multi-level quality control approach emphasizing preventive mechanisms. We highlight the limitations of traditional post hoc peer review under conditions of widespread GenAI adoption. The proposed framework, we suggest, provides methodological foundations for developing encyclopedic web resources while maintaining their scientific and educational value. However, we acknowledge that this conceptual framework requires empirical validation through implementation in specific encyclopedic platforms.

Keywords: web-based information systems, electronic encyclopedia, artificial intelligence, methodology, web resources, generative AI, epistemic quality

1. Introduction

The introduction of generative artificial intelligence (GenAI) into modern practice of working with digital objects, knowledge, and digital information web-based resources (web resources) changes the nature of functioning, as well as the methods and spheres of application of scientific and educational web-oriented automated information systems (WAIS). The creation of such systems [19] and their targeted, scientifically grounded implementation at the international and interstate levels should ensure a significant transformation of everyday, administrative, educational, and production processes in various countries of the world, covering key spheres of social and economic development.

In Gino Roncaglia's work "Encyclopedias and Encyclopedism in the Era of the Internet" [20], a conceptual and analytical generalization of the evolution of digital encyclopedias in the context of technological and cultural transformations is provided. The author outlines successive stages of development of electronic encyclopedias, demonstrating that each of them reflects changes in the methods of organizing knowledge, formats of information presentation, and models of user interaction with encyclopedic resources. The analysis also demonstrates the defining role of technological innova-

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tions that transform the functionality of encyclopedias: from text-centric services to data-oriented semantically sensitive systems. Such evolution provides new opportunities for interactive interaction, intelligent search, and multidimensional knowledge navigation. Summarizing these trends, the author concludes that encyclopedic web resources will continue developing toward integration of structured data, expansion of analytical processing tools, and increasing user engagement, which provides a methodological foundation for our research on the interaction of encyclopedic systems with GenAI technologies.

We now introduce several key concepts that are important for our research.

"Data-oriented encyclopedias" refers to the transition from text articles as the main unit of knowledge to structured data that can be automatically processed. Such encyclopedias are characterized by semantic fields, metadata, RDF (Resource Description Framework) / Linked Data, knowledge graphs, and machine-readable structures. An encyclopedia thus becomes not just a collection of articles, but a knowledge base.

"Semantically sensitive" means that the system understands the meaning of terms, establishes connections between concepts, and takes into account the context of the user's query. Improved user interaction includes navigation through connections between concepts, dynamic prompts, automatic recommendations, and filtering by properties. The user does not simply read an article, but explores a network of knowledge. Automatic term linking, intelligent search, generation of connections, and integration with other knowledge bases facilitate research activities.

This approach relates directly to the development of educational electronic encyclopedias, the use of platform solutions based on MediaWiki and Semantic MediaWiki, the formation of domain-specific terminological systems, and the design of WAIS. We are referring to the type of semantically oriented encyclopedic resources being implemented within the framework of creating the "Ukrainian Electronic Encyclopedia of Education" (https://eduglos.iitta.gov.ua/) and similar scientific information systems. These concepts provide the foundation for analyzing how semantic encyclopedic web resources can integrate with GenAI technologies.

2. Literature review

Recent research on AI and machine learning (ML) applications in academic libraries emphasizes the transformation of their functional and structural characteristics, which is also significant for related information systems. Mupaikwa's review [15] highlights that AI implementation contributes to automating key library processes, including cataloging, indexing, recommendation services, and information retrieval, increasing efficiency of access to knowledge and personalization of user interaction. Analysis of these results identifies several structural-functional characteristics of academic libraries that are relevant for web-oriented encyclopedic resources. Both systems are designed to support user information needs. Although their structural organization differs, both work with large datasets and require efficient indexing and search algorithms. Both develop indexing technologies, semantic analysis, and machine search – common features of their information infrastructure. The information function of libraries, oriented toward ensuring reliability, relevance, and systematicity of knowledge, conceptually aligns with the tasks of encyclopedic platforms.

These findings provide a basis for analyzing AI implementation in web-oriented encyclopedic resources. The principles of automated information processing, intelligent search, and adaptive content presentation can be extrapolated to encyclopedic systems, considering their digital nature and open access. This research thus creates a foundation for understanding the role of generative AI in developing modern information resources.

For example, an intelligent chatbot could instantly answer user questions or explain article content, reducing the load on moderators and increasing knowledge accessibility. Automatic text summarization systems and semantic web tools can help transform complex scientific materials into understandable articles or definitions, facilitating the dissemination of educational resources. Encyclopedias containing hundreds of thousands of articles can apply big data analytics to improve data

quality through automatic tag assignment and detection of semantic connections between concepts. Encyclopedia websites can use ML to analyze search queries, page views, and reading patterns to optimize navigation and content structuring. Algorithms can recommend articles matching readers' interests, improving the personalized experience.

These results show significant potential for integrating library approaches into web-encyclopedic systems, particularly for automating information processing, personalizing services, and optimizing content structure.

Spennemann [21] examines the transformation of public knowledge formation under the influence of AI language models and compares them with traditional encyclopedias. Given the historical outline of encyclopedia development, the author analyzes the risks and opportunities that generative AI carries for scientific-reference information, which is relevant to our research.

Amrollahi et al. [1] studied models of perception of advice provided by GenAI among qualified workers ("information specialists"). The conclusions regarding trust levels, critical factors, and AI implementation recommendations are important for understanding how encyclopedia editors and scientific publishers can interact with GenAI tools in their workflows.

Lee, Jung and Baek [14] demonstrate the application of a fine-tuned LLM model for processing internal technical documentation and evaluate its suitability as a knowledge management tool. The results on advantages and limitations of this approach provide a concrete practical contribution to understanding how encyclopedia analysts could use LLMs for analyzing large volumes of factual information and forming reference content.

Numerous recent studies present positive results on ChatGPT use in library and reference processes (e.g., reader support, bibliographic search). However, practical assessments of LLMs' ability to generate meaningful responses and AI hallucination problems provide useful lessons for encyclopedia authors regarding verification and supplementation of automatically created materials.

3. Research objectives

This study aims to establish methodological foundations for designing, operating, and developing encyclopedic web resources under conditions of GenAI integration, ensuring epistemic quality and scientific reliability.

The specific objectives are:

1) analyze the functioning of encyclopedic web resources and GenAI's transformational impact on their structure, content, and user interaction;

2) identify methodological risks, limitations, and quality requirements for knowledge under GenAI integration;

3) propose methodological approaches for designing and improving encyclopedic web resources that incorporate GenAI appropriately.

4. Theoretical background

The theoretical foundation of the research consists of provisions on WAIS as human–machine intelligent systems, within which encyclopedic web resources are considered as structured, verified, and stable carriers of scientific and educational knowledge. The key concept is GenAI, interpreted as a technological platform that transforms the processes of creating, processing, and presenting knowledge.

The methodological foundation is the systems approach to the analysis and design of encyclopedic web resources. An analytical-synthetic approach was used to generalize results, as well as elements of conceptual modeling to substantiate the directions of development of such web resources.

5. Research methods

This study employs a conceptual framework development methodology, following the established conventions for theoretical research in information science [3]. Conceptual framework papers, as distinguished from empirical studies, aim to synthesize existing knowledge, identify patterns and gaps, and propose new theoretical constructs or methodological approaches that can guide future research and practice [6].

The methodological approach consists of three interconnected phases. First, a structured literature review was conducted to identify the current state of research on GenAI applications in knowledge management systems and encyclopedic platforms. The review encompassed publications from 2021–2026, focusing on: (a) AI applications in academic libraries and information systems [15]; (b) cognitive effects of GenAI on learning and knowledge acquisition [2]; (c) institutional responses to AI-generated content in academic publishing [9, 16]; and (d) epistemic frameworks for digital content quality [4, 22].

Second, a systems analysis was applied to examine encyclopedic web resources as components of web-oriented automated information systems (WAIS). This approach, grounded in general systems theory, enabled identification of structural relationships between technological components, content processes, and quality assurance mechanisms. The analysis drew on established models of Wikipedia quality control [7, 11] and collaborative knowledge systems [25] to ground the theoretical framework in existing empirical research.

Third, an analytical-synthetic approach was used to generalize empirical data and identify key methodological problems. This involved synthesizing findings from multiple domains – information science, cognitive psychology, and AI ethics – to develop an integrated framework for epistemic quality assurance in GenAI-augmented encyclopedic systems.

The materials analyzed include: (1) scientific publications from databases including Scopus, Web of Science, and Google Scholar; (2) empirical studies on GenAI applications in education and information systems; (3) policy documents from academic institutions and publishing platforms regarding AI-generated content; and (4) operational data from the Ukrainian Electronic Encyclopedia of Education project, which served as a case context for applying the proposed framework.

The primary limitation of this methodology is its conceptual nature; the proposed framework requires empirical validation through implementation in specific encyclopedic platforms, which is identified as a direction for future research.

6. Research results

GenAI's transformational impact on the functionality, composition, and structure of WAIS manifests in several ways:

- serving as the technological core for improving user-oriented information functionality of WAIS;
- triggering and enabling transformational improvements in human-machine intelligent systems, especially scientific and educational WAIS;
- catalyzing technological and social changes at the current stage of digital transformation;
- serving as an efficiency indicator for WAIS functioning, reflecting advances in information technology integration.

The GenAI components that drive its transformative impact on knowledge systems and information infrastructure include:

- the intelligent component – GenAI users and various products based on it;

- the flexible, cloud-oriented software component;
- the globally distributed computing infrastructure spanning ground-based, atmospheric, and space systems;
- globally distributed databases of digital data that maintain content, technical, and operational web resources;
- the security component ensuring protection from unauthorized access.

All users of web resources (including WAIS and GenAI users) can be divided into two groups based on their involvement in creating and applying these systems. The *first group* comprises those involved in creating GenAI and WAIS infrastructure: developers of neural network architectures, system architects, and research and production teams. The *second group* comprises users who apply GenAI and WAIS tools in their professional domains: educators, researchers, students, and practitioners across various fields. This classification highlights different responsibilities for ensuring epistemic quality: the first group bears responsibility for the reliability and transparency of the technological infrastructure, while the second group – particularly content creators and editors – must exercise critical judgment when using GenAI tools for knowledge production.

The transformation of the information landscape acquires particular relevance for encyclopedic web-based systems (EWS – a subclass of WAIS), as reference-knowledge human-machine intelligent systems of scientific and educational purpose. In such systems (unlike traditional electronic libraries or repositories), encyclopedic web resources not only identify and display information and technical objects [18], but are also conceptually subordinated to the requirements of structuredness, verifiability, and stability in their design and use.

Figure 1 presents a conceptual architecture for GenAI-integrated encyclopedic web resources, illustrating the relationships between content, semantic, and epistemic layers, as well as the points where GenAI components and human oversight mechanisms intersect.

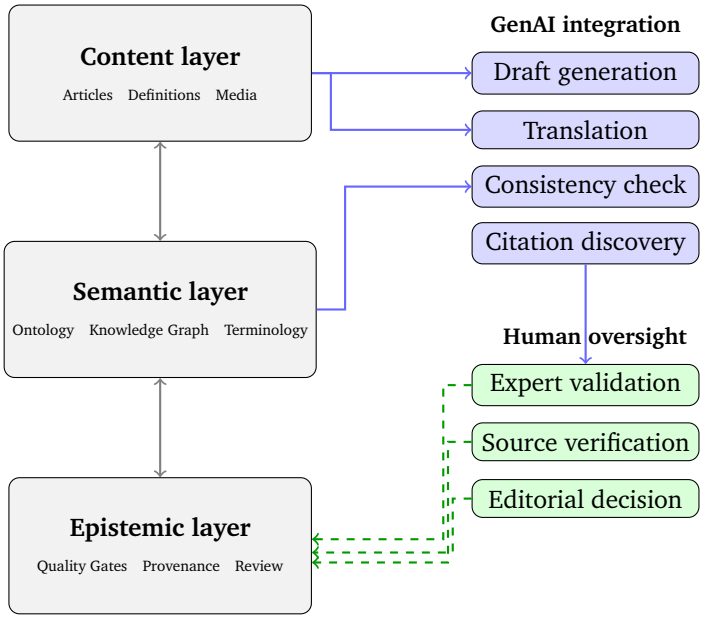

Figure 1: Conceptual architecture for GenAI-integrated encyclopedic web resources. The three-layer structure (content, semantic, epistemic) is shown on the left, with GenAI integration points and human oversight mechanisms on the right. Solid arrows indicate GenAI-assisted processes; dashed arrows indicate human quality feedback.

We now examine the methodological implications for encyclopedic web resources. As shown above, GenAI significantly influences those spheres where it is appropriately applied, including EWS.

However, empirical studies on GenAI applications in education, academic writing, and scientific communication reveal growing risks: automated text production, decreased cognitive engagement, and the emergence of "AI slop" [9] – mass low-quality or hallucinated content. While GenAI integration in EWS is clearly beneficial, we must develop robust methodologies for creating encyclopedic web resources that maintain epistemic quality [17].

To ensure that encyclopedic web resources maintain epistemic quality under GenAI integration, we operationalize five key criteria: justification, reliability, accuracy, verifiability, and consistency. Table 1 defines these criteria for encyclopedic web resources.

Table 1
Operationalization of epistemic quality criteria for encyclopedic web resources.

Criterion	Operational definition	Measurable indicators	Platform mechanisms
Accuracy	Claims match verified sources	Citation rate; contradiction rate; factual error reports	Citation requirements; RAG with source constraints; fact-checking modules
Verifiability	Readers/editors can trace provenance	Provenance completeness; stable source URLs; version history accessibility	Source metadata; URL archiving; DOI integration; edit history
Consistency	No internal contradictions across entries	Ontology constraint violations; cross-reference integrity; terminology conflicts	Knowledge graph constraints; SHACL validation; terminology consistency checkers
Justification	Inclusion based on editorial standards	Coverage rationale documented; editorial decision logs; review completion rate	Editorial templates; decision logs; structured review workflow
Reliability	Stable across time and independent review	Inter-editor agreement rate; retraction rate; content stability index	Multi-stage review; flagged-change system; automated drift detection

These criteria are not independent: accuracy depends on verifiability; reliability presupposes consistency. GenAI affects each criterion differently, necessitating targeted mitigation strategies as outlined in the methodological approaches below.

Recent publications on risks and limitations of GenAI in scientific research and educational systems identify several interconnected groups of empirical arguments with direct methodological implications for encyclopedic web resources.

A large-scale Microsoft Research study analyzing user dialogues with Copilot demonstrates that GenAI is most intensively applied in professional activities involving information work – particularly creating, editing, and summarizing texts [24]. This means encyclopedic web resources potentially become a key sphere of GenAI application. However, effective performance on information tasks does not guarantee scientifically correct results that meet epistemic quality criteria. A methodological tension thus arises between the speed and convenience of GenAI-based EWS and knowledge reliability, creating a zone of increased responsibility for researchers and educators.

Studies in education and cognitive psychology document negative effects of uncontrolled GenAI use for learning and writing. Students who actively use ChatGPT for writing essays or solving problems show worse indicators of long-term memorization and depth of understanding compared to those who work without GenAI or use it only at the editing stage [2, 12]. These results correlate with cognitive load theory [23], which emphasizes that active mental processing of information is essential for meaningful knowledge formation. For encyclopedic web resources, this means that automated generation of articles or knowledge fragments is not a methodologically neutral practice, since it affects the epistemic status of content and the nature of user interaction.

Changes in arXiv policies [9] and crisis situations at major scientific conferences (ICLR, NeurIPS) [16] illustrate the institutional dimension of the problem. The introduction of additional moderation

procedures, restrictions for new authors, and translation requirements responds to the sharp increase in low-quality or partially AI-generated materials. These examples show that even in environments with established academic norms, special methodological mechanisms of content filtering and verification are needed. For encyclopedic web resources, this translates into requirements for using automated tools with human expert participation and implementing multi-level quality control models for generated content.

These empirical findings support several key methodological approaches for encyclopedic web resources under GenAI integration.

The **human-centered approach** establishes principled role delineation: GenAI serves as a support tool, while content formation, source interpretation, and publication decisions remain exclusively with human experts. This approach prioritizes epistemic justification and reliability over efficiency gains.

GenAI permitted uses:

- Search and preliminary identification of relevant sources
- Language editing and translation of human-authored content
- Generation of preliminary outlines from verified source lists (not publication-ready text)
- Terminology suggestions and concept mapping

GenAI prohibited uses:

- Generation of publication-ready content without human authorship
- Citation or reference generation (risk of hallucinated sources)
- Autonomous content decisions regarding inclusion or emphasis

Workflow: (1) Expert defines topic scope and identifies authoritative sources; (2) Expert authors content, optionally using GenAI for language refinement; (3) Expert verifies all claims against primary sources; (4) Peer review by domain expert; (5) Publication with human authorship attribution.

This approach aligns with research showing effectiveness of GenAI as “Socratic” support assistance at later stages of work, but not as a substitute for authorial activity [10]. “Socratic” support involves GenAI asking clarifying questions, suggesting reasoning directions, and stimulating independent formulation of conclusions – supporting cognitive engagement rather than replacing it.

The **hybrid approach** integrates GenAI into the technological architecture under clearly defined scenarios, with mandatory expert validation before any GenAI-assisted content reaches publication.

GenAI permitted uses:

- Draft generation from specified, verified source documents (via RAG)
- Automated prompts about related concepts and cross-references
- Terminology consistency analysis across related entries
- Detection of gaps in article structure
- Translation and multilingual content generation
- Summarization of lengthy source materials for editorial review

GenAI prohibited uses:

- Publication of any GenAI output without expert review
- Generation of content from unspecified or unverified sources

- Autonomous updating of published entries

Workflow: (1) *Topic selection* – editorial board defines scope, assigns to expert; (2) *Source specification* – expert identifies approved source corpus; (3) *Draft generation* – GenAI generates draft from approved sources with citation slots; (4) *Automated checks* – consistency, terminology, and style validation; (5) *Expert review* – domain expert validates all claims, adds interpretation, verifies citations; (6) *Provenance labeling* – document GenAI contribution level; (7) *Publication* – versioned release with transparent provenance.

This approach corresponds to modern tendencies in knowledge systems design [13], combining machine processing efficiency with human expertise for quality judgment.

The **quality control approach** addresses the insufficiency of traditional post hoc peer review under conditions of widespread GenAI adoption. It emphasizes preventive mechanisms throughout the content lifecycle.

Key mechanisms:

- *Content provenance:* Every content fragment carries metadata indicating author type (human/GenAI), source documents used, review status, and change history.
- *Machine-generated fragment marking:* Visual indicators (visible to editors, optional for readers) identify text originating from GenAI, enabling targeted verification.
- *Multi-level expert verification:* Tiered review based on content sensitivity – foundational concepts require senior expert approval; routine entries may use community review.
- *Transparent GenAI usage rules:* Platform policies explicitly define acceptable GenAI applications, disclosure requirements, and consequences for policy violations.
- *Post-publication monitoring:* Automated drift detection flags content that may require updating due to source changes or accumulated corrections.

Quality gates:

1. *Input gate:* Source verification before any GenAI processing
2. *Processing gate:* Constraint validation during generation (terminology, ontology, style)
3. *Output gate:* Expert review before publication
4. *Maintenance gate:* Periodic review triggers and user feedback channels

This approach reflects what is increasingly termed “epistemic responsibility” of digital platforms [4, 22] – the embedding of human accountability into design, rules, and algorithms.

Table 2 summarizes the distinguishing characteristics of each approach.

At the same time, it should be noted that despite the growth in the number of publications on the use of GenAI in education and scientific communication, research that directly analyzes the methodology of modeling encyclopedic web resources under the condition of using GenAI and EWS on its basis remains limited. This creates certain methodological gaps and limits the possibilities of direct comparison of approaches, which can also be considered as a partial result of this very author’s analytical search.

7. Case application: Ukrainian Electronic Encyclopedia of Education

The Ukrainian Electronic Encyclopedia of Education (https://eduglos.iitta.gov.ua/) serves as a concrete instantiation of the methodological framework proposed in this article. This platform, developed by the Institute for Digitalisation of Education of the National Academy of Educational

Table 2
Comparison of methodological approaches for GenAI integration.

Dimension	Human-centered	Hybrid	Quality control
Primary focus	Epistemic justification	Efficiency with validation	Systematic risk mitigation
GenAI role	Support tool only	Draft generation + analysis	Integrated but monitored
Human role	Author, interpreter, decider	Validator, interpreter	Governor, auditor
Speed of production	Lowest	Moderate	Moderate–High
Epistemic risk	Lowest	Moderate	Controlled
Implementation complexity	Low	Moderate	High
Best suited for	Foundational content, controversial topics	Scale expansion, translations	Platform-wide policy

Sciences of Ukraine, represents a domain-specific encyclopedic web resource focused on educational terminology, pedagogical concepts, and educational technology [18, 19].

The platform currently operates as a MediaWiki-based system with semantic extensions (Semantic MediaWiki), enabling structured data storage and querying. Key characteristics include:

- *Content scope:* Terminology and conceptual apparatus of education and psychology, including pedagogical and psychological concepts, methodological frameworks, and definitions of educational technologies
- *Editorial model:* Expert-driven with institutional oversight from the National Academy of Educational Sciences
- *Quality mechanisms:* Peer review by domain experts, terminology consistency checking, editorial board approval for new entries
- *Technical infrastructure:* Wiki-based collaborative editing, semantic properties for structured metadata, categorized knowledge organization

As of 2025, the encyclopedia contains approximately 500 entries spanning pedagogical theory, educational psychology, information technologies in education, and related disciplines. The platform serves researchers, educators, students, and educational administrators across Ukraine.

Applying the framework developed in this article, several potential GenAI integration points have been identified for the Ukrainian Electronic Encyclopedia:

1. Permitted GenAI applications (hybrid approach):
    - *Terminology suggestions:* GenAI can propose related concepts and cross-references when editors create or expand entries, drawing on the existing semantic structure.
    - *Translation assistance:* Given the need for multilingual educational terminology (Ukrainian–English–other languages), GenAI-assisted translation with expert review can accelerate internationalization.
    - *Consistency checking:* Automated verification that new entries use consistent terminology with existing articles, leveraging the semantic knowledge graph.
    - *Draft generation from verified sources:* For routine definitional entries, GenAI can generate initial drafts from specified source documents (e.g., educational standards, official terminology lists), subject to expert validation.

- *Gap detection:* Analysis of coverage patterns to identify missing concepts or incomplete cross-referencing.
- *Semantic markup generation:* GenAI can assist editors in automatically forming semantic markup for author texts, facilitating structured data extraction and integration with the knowledge graph.

2. Prohibited GenAI applications:
   - Autonomous publication without human review
   - Generation of content from unspecified or unverified sources
   - Citation or reference creation (due to hallucination risk)
   - Content decisions regarding inclusion criteria

For a new article on an educational concept, the proposed workflow integrates the quality control approach:

Stage 1 – Intake: Editorial board assigns topic scope and identifies authoritative source corpus (e.g., national educational standards, peer-reviewed publications, official terminology documents).

Stage 2 – Human-authored draft: The human author (an NAES researcher or domain expert) writes the initial article draft. If using the hybrid approach, GenAI may assist with supplementary materials only – suggested cross-references, related concepts, or candidate definitions drawn from approved sources – all of which are explicitly marked provisional and subject to expert selection.

Stage 3 – Automated checks: The system runs consistency validation (terminology alignment with existing entries), style compliance, and metadata completion. Entries failing automated checks return to Stage 2.

Stage 4 – Expert review: A domain expert validates all claims, verifies citations against primary sources, and adds interpretive context. The expert confirms provenance metadata indicating the degree of GenAI contribution.

Stage 5 – Publication: Versioned release with transparent provenance labeling (e.g., "Human-authored"; "GenAI-assisted draft, expert-reviewed"; "Translation from Ukrainian, GenAI-assisted, verified").

Stage 6 – Post-publication monitoring: Automated drift detection flags entries where source documents have been updated or where user feedback indicates potential issues. Periodic review cycles ensure continued accuracy.

The implementation of this framework in the Ukrainian context requires addressing several practical considerations. First, training data for GenAI tools in educational domains may have limited coverage of Ukrainian-language educational terminology, necessitating careful evaluation of output quality. Second, the platform's institutional governance structure (National Academy of Educational Sciences) provides an established framework for editorial oversight, which can be extended to include GenAI usage policies. Third, the existing semantic infrastructure (Semantic MediaWiki) enables implementation of automated consistency checks and provenance tracking without major architectural changes.

A pilot implementation focusing on terminology translation and cross-reference suggestions is planned as an initial validation of the proposed methodological approach, with measurable quality indicators including: error rates in GenAI-generated vs. human-authored content, editor time required for validation, and user satisfaction scores.

8. Discussion

The proposed methodological framework for GenAI integration in encyclopedic web resources offers a structured approach to preserving epistemic quality while leveraging the capabilities of generative AI. This section situates our findings within the broader landscape of knowledge management systems, discusses practical implications, and acknowledges limitations.

The three-approach framework we propose – human-centered, hybrid, and multi-level quality control – can be contrasted with existing models in collaborative knowledge systems. Wikipedia, the largest encyclopedic web resource, has developed sophisticated quality control mechanisms over two decades [7, 11], including automated vandalism detection, community review processes, and verifiability requirements. However, Wikipedia's current policy explicitly prohibits using LLM-generated text in mainspace articles [25], representing a predominantly human-centered approach that largely excludes GenAI from content creation.

Our framework suggests a more nuanced integration strategy. The hybrid approach, in particular, offers a middle ground between Wikipedia's current restrictive stance and fully automated content generation. By defining clear scenarios where GenAI can assist (e.g., terminology suggestions, translation, initial drafting from verified sources) while maintaining mandatory human verification before publication, encyclopedic platforms can benefit from GenAI efficiency without sacrificing reliability.

Scholarpedia, which employs expert-only curation with formal peer review, represents an alternative model emphasizing quality over scale [5]. Our multi-level quality control approach shares Scholarpedia's commitment to expert validation but proposes preventive mechanisms (provenance labeling, automated consistency checks) that may reduce the burden on expert reviewers while maintaining rigor.

The five criteria of epistemic quality – justification, reliability, accuracy, verifiability, and consistency – provide a structured vocabulary for evaluating GenAI's impact on encyclopedic content. These criteria are not merely theoretical constructs; they translate into specific platform mechanisms. For instance, verifiability requirements can be operationalized through mandatory citation requirements and provenance metadata, while consistency can be monitored through automated ontology checking and knowledge graph constraint validation.

A critical finding from our analysis is that GenAI affects each criterion differently. Hallucinations directly threaten accuracy [8], while automated text generation may compromise verifiability if source tracing is not maintained. The human-centered approach prioritizes justification (through expert interpretation) and reliability (through human judgment), while the hybrid approach can enhance accuracy and consistency through automated checking of defined parameters.

The framework has practical implications for the governance of encyclopedic platforms. First, platform policies must explicitly define acceptable GenAI use cases and disclosure requirements. The arXiv policy changes and conference moderation procedures discussed earlier [9, 16] represent institutional responses that encyclopedic platforms can adapt. Second, provenance labeling – clearly marking which content was AI-assisted versus human-authored – enables readers to calibrate their trust appropriately.

Third, the role delineation between GenAI and human experts requires explicit governance structures. Our framework suggests that final editorial decisions, interpretation of sources, and inclusion criteria should remain human responsibilities, while GenAI can assist with drafting, translation, consistency checking, and citation discovery.

The three approaches are not mutually exclusive but rather represent a toolkit to be applied contextually:

1. Human-centered approach is most appropriate for: foundational articles defining core concepts; entries on controversial or rapidly evolving topics; content requiring nuanced interpretation of primary sources; and any material with significant educational or policy implications.

2. Hybrid approach is most appropriate for: expanding coverage in well-established domains; updating existing articles with new developments; generating translations and multilingual content; and creating initial drafts from verified source materials that will undergo expert review.

3. Multi-level quality control is essential for: high-traffic articles with frequent updates; entries with significant public interest or policy relevance; content in domains where accuracy is critical (e.g., medical, legal, scientific); and any platform-wide implementation of GenAI tools.

9. Limitations

This study has several limitations that must be acknowledged. First, the proposed framework is conceptual and has not been empirically validated through implementation in a specific encyclopedic platform. While we draw on established research in knowledge management and cognitive psychology, the effectiveness of the three approaches in practice remains to be tested. Future research should include case studies applying this framework to platforms like the Ukrainian Electronic Encyclopedia of Education, with measurable outcomes for content quality and editor efficiency.

Second, our analysis focuses primarily on text-based encyclopedic content. The implications of GenAI for multimedia content (images, video, audio) in encyclopedic resources require separate analysis, as the technical challenges and quality control mechanisms differ significantly.

Third, the framework addresses epistemic quality but does not fully address other important dimensions such as accessibility, inclusivity, and representation. GenAI tools trained on existing encyclopedic content may perpetuate biases and exclusions present in training data [4]. These considerations, while beyond the scope of this analysis, are essential for comprehensive platform governance.

Fourth, the rapidly evolving landscape of GenAI technology means that specific recommendations may require revision as new capabilities and limitations emerge. The framework is designed to be adaptable, but its implementation details should be periodically reassessed.

10. Conclusions

This article has argued that encyclopedic web resources as a subclass of WAIS undergo significant transformation under the influence of GenAI, which acts both as a technological core and as a catalyst for the development of their functional capabilities. GenAI expands the toolkit for working with content (generation, editing, summarization), changes the nature of user interaction with the resource, and increases the level of automation of information processes. At the same time, this necessitates reconsidering the role of encyclopedic resources as systems in which the technological capabilities of AI and human expert activity are combined.

The use of GenAI is accompanied by a number of significant methodological risks, among which the key ones are the appearance of unreliable or “hallucinated” content, a decrease in the level of cognitive engagement of users, and the devaluation of scientific verification procedures. This sharpens the problem of ensuring the epistemic status of knowledge in encyclopedic web resources.

We have proposed a set of complementary methodological approaches to the design and development of encyclopedic web resources with the use of GenAI: a human-centered approach emphasizing expert control, a hybrid approach defining GenAI integration scenarios with mandatory validation, and a multi-level quality control approach implementing preventive mechanisms throughout the content lifecycle. These approaches, we suggest, provide a methodological foundation both for developing new and for improving existing encyclopedic web resources while preserving their scientific and educational value.

This conceptual framework requires empirical validation. The authors plan to direct further research toward: (1) implementation of the proposed framework in the Ukrainian Electronic Encyclopedia of Education, with measurable quality indicators; (2) comparative analysis of GenAI-assisted vs.

traditional content creation workflows, measuring error rates, editor time, and quality outcomes; (3) development of standardized provenance metadata schemas for AI-assisted encyclopedic content; and (4) expert evaluation studies to refine the decision criteria for when each methodological approach is most appropriate. These studies would provide the empirical grounding needed to validate or revise the framework proposed here.

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Declaration on Generative AI

In the research, artificial intelligence tools were used only for checking the translation of the article abstract using the Grammarly service. This ensured increased grammatical accuracy and compliance with academic standards of scientific writing.

Author contributions

Conceptualization, V.Yu.B. and O.P.P.; methodology, V.Yu.B.; investigation, O.P.P.; writing – original draft preparation, V.Yu.B. and O.P.P.; writing – review and editing, O.P.P. All authors have read and agreed to the published version of the manuscript.

Conflicts of interest

The authors declare no conflict of interest.

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