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Pyramid of Contribution Review: A Structured Model for Functional Literature Integration in Scientific Writing

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Abstract: Although methodological innovations have reshaped many aspects of scientific writing, literature reviews remain one of its most structurally underdeveloped and conceptually inconsistent components. Existing approaches often fail to communicate the functional role of individual sources within the research argument, leaving both readers and reviewers without a transparent sense of contribution, coherence, or originality. This paper introduces the Pyramid of Contribution Review (PCR), a novel framework that visually and functionally maps references according to their role in the manuscript (Introduction, Methodology, Results, Discussion, Gap) and their level of relevance. Through a mixed-methods validation process, including expert-based Delphi design (n = 28) and a large-scale evaluation survey (n = 118), the method was rigorously tested across disciplines. Statistical analyses reveal that manuscripts perceived to employ the PCR model are 3.45 times more likely to be rated as publishable compared to those relying on conventional narrative reviews. Experts overwhelmingly endorsed the model for its clarity, strategic value, and pedagogical utility. This study positions the PCR framework not only as a solution to a long-standing structural gap in scientific writing but as a forward-looking standard for literature organization in high-impact research. The future of scholarly communication requires not just citation density but citation precision, exactly what the PCR model provides.

Keywords: Literature review structuring; Contribution mapping; Manuscript architecture; Publication strategy; Academic writing tools

1. Introduction

Writing a high-quality scientific manuscript requires not only methodological rigor and original findings but also a well-structured and purposeful integration of existing literature (Thaichana et al., 2025). The literature review section, often seen as a formal necessity rather than a critical foundation, is frequently criticized for being descriptive, disconnected, or overwhelming (Adeoye, 2024; Heston, 2024; Piran & Tran, 2024). Authors may struggle to link references to specific parts of their research logic or to present prior studies in a way that clearly shows how they inform the current work. Furthermore, a preliminary, critical exploration of the existing body of research is essential before manuscript development begins. Authors must assess whether the intended topic has been sufficiently studied, whether it represents a true novelty with scientific significance, and whether divergent perspectives or conflicting conclusions already exist within the field. Only after such a systematic evaluation can the justification for writing a new manuscript be firmly established. In recent years, various approaches to literature synthesis have been proposed to overcome these limitations, including thematic mapping (Antons et al., 2021; Linnenluecke et al., 2020), matrix methods (Goldman & Schmalz, 2004), and bibliometric visualizations (Sajovic & Boh Podgornik, 2022; van Eck & Waltman, 2014). While these methods offer valuable structure, they often emphasize thematic clustering or citation networks rather than the functional role of references within the structure of a scientific article (e.g., introduction, methodology, results, and discussion). As a result, there remains a need for a transparent, flexible, and intuitive approach that helps both authors and readers understand how each cited source contributes to the research (Haghani, 2023; Moravcsik, 2020; Prager et al., 2018).

This paper proposes a novel visual and conceptual framework, the ASTRA Pyramid (Analytical Structure for

Thematic Reference Allocation), which organizes literature references based on their section-specific function in the manuscript and their degree of relevance. The acronym ASTRA is derived from the first names of the method's co-developers and symbolically represents the structured and contribution-oriented nature of this innovative approach to literature synthesis. To situate the model within the broader landscape of scientific writing tools, it is also called the Pyramid of Contribution Review (PCR), particularly when emphasizing its operational function within manuscript preparation. Throughout this paper, the term ASTRA Pyramid refers to the structural framework, while PCR refers to its functional application in literature synthesis and manuscript organization. The model builds on the idea that not all references serve the same purpose, and that a structured, visual categorization of citations can enhance both the clarity of the literature review and the transparency of academic argumentation. Inspired by hierarchical representation formats (e.g., Bloom's taxonomy, logic trees, or evidence mapping techniques), the PCR model positions references across five manuscript-relevant layers: Introduction, Methodology, Results, Discussion, and Gap. Each reference is visually marked with a color to indicate its relative relevance, high (green), moderate (yellow), or low (red), while the top of the pyramid identifies the conceptual or methodological gap that the current study addresses.

The aim of this paper is to present the theoretical foundation, structure, and potential applications of the PCR model. To illustrate its practical use, we include an applied example based on a fictional research study in the field of child pedestrian safety. In addition, we report the results of an expert-based validation study involving 118 academics from diverse fields, using both Likert-scale evaluations and binary logistic regression to assess the method's clarity, utility, and perceived impact on publication outcomes.

The paper is structured as follows: First, we present the conceptual framework and structure of the PCR model. Second, we provide a practical implementation example. Third, we describe the methodology and results of the expert evaluation study. Finally, we discuss the implications, potential benefits, and limitations of the approach, and propose future directions for research and application. By offering a systematic, transparent, and functionally oriented integration of sources, the PCR model aspires to redefine best practices in the preparation and evaluation of scholarly manuscripts.

2. Methodology

2.1 Development of the ASTRA Pyramid Framework and PCR Model

The conceptualization of the "ASTRA Pyramid" originated from the observed limitations of conventional literature reviews, which often suffer from descriptive monotony, lack of critical structure, and difficulty in explicitly demonstrating how individual references support different parts of the manuscript. To address these issues, a new visual, stratified citation synthesis framework was developed under the working name PCR model.

The PCR model organizes the cited literature into a hierarchical, pyramid-shaped structure, where each level corresponds to a major structural component of the scientific paper: Introduction, Methodology, Results, and Discussion. Each cited paper is assigned to the level where its contribution is most relevant. Within each level, color shading is used to indicate the degree of alignment or contribution to the current study, with darker tones representing higher relevance. At the apex of the pyramid, a designated "Research Gap" zone is formed, representing the collective shortcomings or unresolved issues from the included literature that the current study aims to address. This design aims to simultaneously offer clarity to the reader, enhance transparency in the use of literature, and facilitate critical engagement with previous work. A conceptual overview of this structure is illustrated in Figure 1, which presents the PCR model as a color-coded pyramid aligned with standard manuscript sections.

2.2 Delphi Method and Questionnaire Design

To develop and validate an appropriate evaluation tool for assessing the PCR model method, a Delphi study was conducted involving 28 recognized international experts from a diverse array of disciplines. The selection criteria included active academic status (at least PhD level), peer-reviewed publications in Web of Science or Scopus journals, and demonstrable experience in reviewing or editing scientific manuscripts. The Delphi process occurred in three rounds:

Round 1: Open-ended feedback on the core concept and proposed structure of the method.
Round 2: A draft version of the visual method was shared, and experts evaluated its clarity and relevance.
Round 3: The panel reviewed and finalized the evaluation questionnaire consisting of eight thematic questions, along with a demographic section.

Consensus among experts was defined as a minimum of 80% agreement across the panel, which is a standard threshold in Delphi studies to indicate convergence of expert opinion. In practical terms, this meant that for any given item in the evaluation questionnaire, at least 22 out of the 28 participating experts had to express either agreement or strong agreement with the item's relevance, clarity, or importance for it to be included in the final

version. This threshold was applied uniformly across all rounds of the Delphi process. Items that did not reach the consensus threshold in Round 1 were revised based on qualitative feedback and re-evaluated in subsequent rounds. By the end of Round 3, all items that appeared in the final survey instrument had reached or exceeded the 80% agreement threshold, ensuring that the final version of the evaluation tool represented a strong, expert-validated set of criteria.

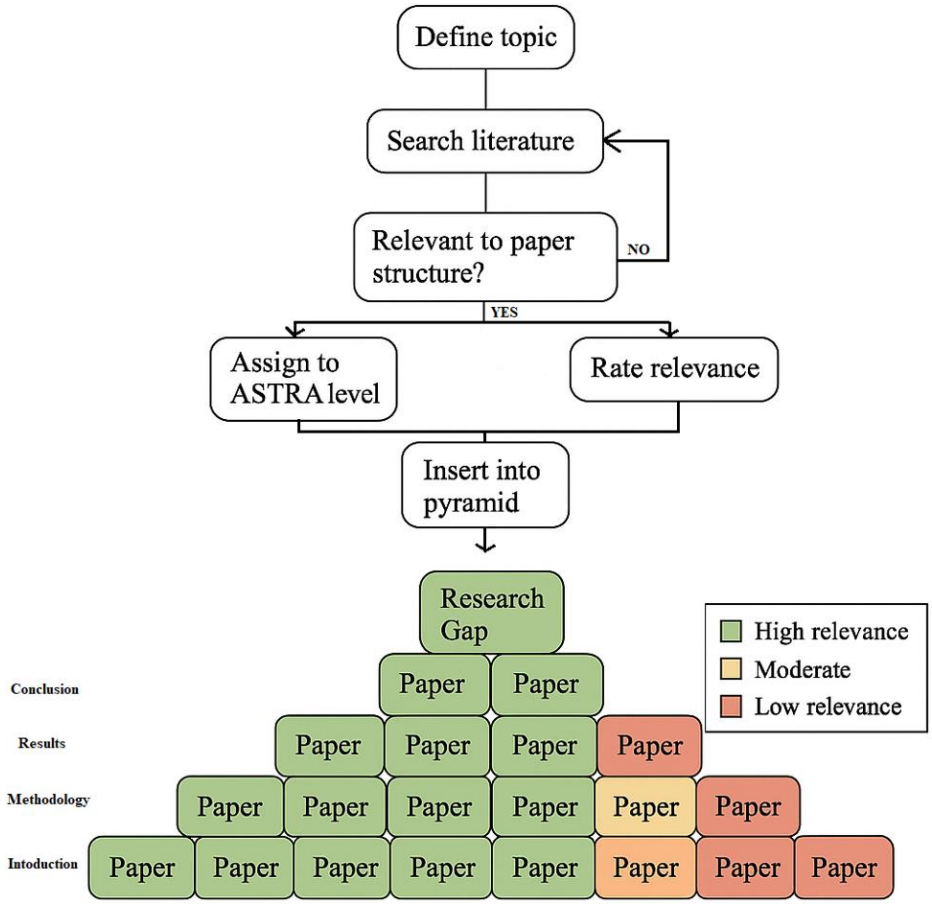

Figure 1. Schematic representation of the PCR model across manuscript sections

2.3 Survey Instrument and Demographic Variables

The finalized evaluation instrument used to assess the PCR model method was divided into two main sections: Section A: Demographic Information, and Section B: Evaluation of the Method. This structure enabled both a contextual understanding of the participants and a multidimensional evaluation of the proposed methodological innovation. Section A collected essential demographic data to ensure diversity in perspectives and enable subgroup analysis. Participants were asked to provide the following information:

- Gender: Male, Female, or Prefer not to say, allowing for inclusive and anonymized reporting.
- Year of Birth: to examine generational perspectives on the clarity and usability of visual literature synthesis methods.
- Academic Position: selected from predefined categories: Professor, Associate Professor, Assistant Professor, Postdoctoral Researcher, or PhD Candidate.
- Number of Peer-Reviewed Publications: to jointly assess academic longevity and research productivity, providing a more comprehensive measure of scholarly engagement and its correlation with perceived utility of the method.
- Field of Research: categorized broadly to allow discipline-specific insights.
- Country of Affiliation: to evaluate potential cultural or regional influences in the adoption of innovative literature review techniques.

Section B contained eight items focused on evaluating the core characteristics and potential impact of the PCR model. Items 1 through 7 were closed-ended and designed to capture quantifiable opinions using a 6-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Slightly Disagree, 4 = Slightly Agree, 5 = Agree, 6 = Strongly Agree). Item 8 was open-ended, allowing participants to freely express qualitative suggestions regarding the clarity,

usability, or scope of the method. The items were as follows:

1. “The pyramid structure is clear and logically organized.”

This item evaluates whether the hierarchical structure and logical flow of the PCR model are perceived as intuitive and clearly aligned with the organization of a scientific manuscript.

2. “The method improves understanding of each reference’s role in the manuscript.”

This item assesses whether the PCR model helps participants clearly understand the specific functional role that each cited reference plays within the structure of a scientific manuscript.

3. “It facilitates clearer identification of the research gap.”

A key innovation of the method, this item gauged whether the visual organization clarified conceptual or methodological voids in the literature.

4. “The method increases the chance of publication.”

This item assesses whether participants perceive that using the PCR model improves the likelihood of a manuscript being accepted for publication by enhancing clarity, structure, and the strategic presentation of cited literature.

5. “I would recommend this method to other researchers.”

This item measures the participant’s willingness to endorse the PCR model to peers, reflecting overall satisfaction and perceived value of the approach for broader academic use.

6. “I would consider using this method in my own writing.”

This item evaluates the participant’s personal intention to adopt the PCR model in their future scientific writing, indicating practical applicability and perceived usefulness at the individual level.

7. “The PCR model is applicable across different types of academic papers (e.g., systematic reviews, empirical studies, dissertations, grant proposals, teaching materials)?”

This item identifies the types of academic papers where participants believe the PCR model would be most beneficial, providing insights into its perceived scope of applicability across different research outputs.

8. Participants were invited to freely express suggestions for improving the clarity, usability, or scope of the method.

Participants were invited to freely express suggestions for improving the clarity, usability, or scope of the method. The finalized instrument was distributed electronically using a secure online survey platform. All responses were collected anonymously between January and March 2025. The survey was preceded by a mandatory informed consent page, clearly outlining the purpose of the study, the voluntary nature of participation, and the right to withdraw at any time without consequences. Participation was completely unpaid, and no form of financial or material compensation was offered to respondents. All procedures adhered to standard ethical guidelines for social science research, including data protection, voluntary participation, and anonymity. The study was conducted in line with the principles of the Declaration of Helsinki and institutional ethical protocols where applicable. The majority of participants were recruited through direct personal invitations and academic contacts, ensuring high credibility of respondents and a high response rate. The final response rate exceeded 90%, and the demographic structure of the sample confirmed a high level of international representation and disciplinary diversity, which strengthened the generalizability and relevance of the evaluation results.

2.4 Statistical Analysis

The collected responses were compiled, preprocessed, and cleaned using Microsoft Excel, while statistical analysis was performed using SPSS Statistics 29.0 and Python libraries (pandas, stats models, seaborn, matplotlib). The analysis was designed to explore the characteristics of respondents, assess overall trends in the evaluation of the PCR model, and identify any significant predictors of perceived publication success.

Descriptive statistics were used to summarize the demographic characteristics of participants, as well as distribution patterns of responses to individual items. This included the calculation of frequencies, percentages, means, and standard deviations, along with visual representations such as bar and pie charts. To explore potential associations and differences between variables, inferential techniques such as chi-square tests, t-tests, one-way ANOVA, and correlation analysis (Pearson and Spearman) were employed where applicable. Finally, to assess whether the method was perceived to influence manuscript acceptance, binary logistic regression was used. The dependent variable was the perceived increase in the likelihood of publication, while independent variables included demographic characteristics and evaluative scores. Model validity was examined through standard procedures, including multicollinearity testing and fit diagnostics. This integrated statistical strategy enabled both general summarization and a deeper examination of how the method was evaluated across different expert profiles.

3. Results

This chapter is divided into two main sections. The first presents a practical implementation of the PCR model applied to the literature synthesis of the current study, serving as an illustrative example of how the model functions

in organizing and classifying scientific references. The second section presents the results of the expert survey, which was conducted to assess the perceived clarity, utility, and publication relevance of the method. The structure is designed to demonstrate both the applied and evaluated dimensions of the proposed contribution.

3.1 Implementation Example: PCR Model in Literature Review

This section provides a practical example of how the PCR model can be applied within the context of a research manuscript. Cited sources are systematically classified and positioned according to their primary function within the structure of a scientific paper, namely, contributing to the Introduction, Methodology, Results, or Discussion. At the apex of the pyramid, the Gap zone identifies the collective limitations or shortcomings of the reviewed literature, which the current study aims to address. This structured visual arrangement highlights not only the role of each reference but also its degree of relevance in shaping different components of the manuscript. As a demonstration, Table 1 presents the PCR model as applied to a hypothetical study titled "A Multimodal Intervention Model for Improving Children's Perception and Behavior in Occluded Traffic Environments." This is a demonstrative example, and the paper does not actually exist. The pyramid visually organizes references used in the conceptual development of this imaginary manuscript and uses color coding to reflect the relative relevance of each cited source. The following color scheme was used:

Green – High relevance: the source directly supports the corresponding section of the manuscript and aligns closely with its focus.

Yellow – Moderate relevance: the source provides partial or contextual support but is not central to the argument or design.

Red – Low relevance: the source is tangential, older, or used for background context only.

N.A. – Not applicable or not available: this designation is used when no directly relevant reference could be identified for a specific section. This may also reflect a gap in the literature.

Table 1 demonstrates how literature can be organized using the PCR model format. The number and type of columns can be adapted depending on the research topic and the author's preference. The pyramid may include only citations, or it may contain citations with full reference titles, or even brief summaries of each source's contribution. Unlike traditional linear literature reviews, the PCR model explicitly connects each cited work to a specific section of the manuscript based on its functional contribution, Introduction, Methodology, Results, or Discussion. The hierarchical organization is intentionally designed to mirror the narrowing focus of a scientific paper: the base of the pyramid (Introduction) typically includes the largest number of references, reflecting the broader theoretical, contextual, and empirical background; the middle layers (Methodology and Results) contain progressively fewer references, as the literature here must closely align with the specific procedures, instruments, models, or findings relevant to the current study; the upper layer (Discussion) includes selected references directly used for comparative interpretation or theoretical reflection; while the apex of the pyramid (Research Gap) captures the unresolved questions or deficiencies identified across the cited works, providing a direct logical bridge to the necessity and novelty of the new research. One of the key strengths of the PCR model is that it allows for empty or sparsely populated levels when necessary. For example, in highly innovative studies where no close methodological antecedents exist, the Methodology section of the pyramid might intentionally contain few or no references. Such asymmetries are not seen as deficiencies but rather serve as visual indicators of originality or field-specific gaps. It is also permitted, and sometimes even recommended, for the same reference to appear across multiple levels of the pyramid if it fulfills multiple roles. For instance, a foundational theoretical paper could simultaneously inform the Introduction, justify the Methodology, and be revisited in the Discussion. Nevertheless, authors are encouraged to supplement each manuscript section with new, section-specific references where possible, to maintain depth, context sensitivity, and avoid excessive redundancy. By visually and functionally systematizing references in this manner, the PCR model enhances the transparency of how previous work underpins each part of the new study. It also provides an efficient mechanism for both authors and reviewers to detect unaddressed gaps or areas where the current research extends, challenges, or complements the existing knowledge base. This approach is particularly useful for identifying areas where additional literature is needed, improving transparency in manuscript preparation, and supporting structured academic writing, especially in multidisciplinary contexts.

The PCR model is intentionally flexible. It may be customized according to the specific focus of the study: in methodology-driven research, the Methodology level may be populated more densely, reflecting detailed technical alignments and adaptations; in conceptual or theoretical work, the Introduction and Research Gap zones may predominate, as they anchor the paper's intellectual positioning; and in empirical exploratory studies, the Results and Discussion layers may be relatively more developed to accommodate comparative analysis with prior findings. Overall, the PCR model serves as both a visual map and a conceptual audit tool, guiding authors to systematically assess the sufficiency, relevance, and logical integration of prior literature, while simultaneously making the construction of new scientific contributions more transparent to readers and evaluators.

Table 1. Structured mapping of references using the PCR model (expanded version with descriptive annotations)

Gap				Lack of integrated, theory-based approaches addressing both child cognition and real-world crossing environments.				
Conclusion				Wang et al. (2025) Intervention improved traffic safety literacy, especially in low-literacy children.	Tomoda et al. (2022) Footprint marks improved children's stopping behavior at intersections; color pavement was less effective.			
Results			Wang et al. (2025) Tested combined peer discussion and VR training on 120 children to improve traffic safety literacy.	Masuri et al. (2012) Examined driver behavior using ergonomics principles in a road safety context.	Gregersen & Nolén (1994) Club members showed higher accident risk despite better safety behavior.	N.A.		
Methodology		Morrongiello et al. (2019) Measured children's street-crossing behavior in immersive VR under varying traffic conditions.	Lee et al. (2018) Retrospective analysis of child traffic injuries by severity score.	Gregersen & Nolén (1994) Evaluated traffic impact on accident risk using questionnaire data from children in Sweden.	Christie et al. (2004) Analyzes international data and countermeasures for child road safety under age 15.	Feng et al. (2025) Tested cognitive and agency-based intervention on 48 children using eye-tracking and perception scales.	N.A.	
Introduction	Schwebel et al. (2012) Explores links between child traffic safety and urban environment, framing the relevance of spatial factors.	Riaz et al. (2022) Presents global and European trends in child traffic safety, highlighting systemic issues.	Ötvös et al. (2025) Emphasizes the vulnerability of child road users and the need for systemic safety measures.	Li et al. (2016) Highlights child road traffic injuries as a major global health issue.	Suzanne Zeedyk et al. (2010) Highlights the lack of evidence on the effectiveness of child road safety education programs.	Christie et al. (2004) Introduces the need for internationally comparable data to support child road safety policy and practice.	Feng et al. (2025) Highlights the gap between children's cognitive abilities and traffic demands.	Goniewicz et al. (2016) Highlights global trends and key risks in child pedestrian safety, with a focus on urban crosswalks.

Note: Green-High relevance; Yellow-Moderate relevance; Red-Low relevance

Table 2 presents a simplified application of the PCR model, in which the cited literature is visually categorized based on its functional contribution to different sections of a scientific manuscript: Introduction, Methodology, Results, Conclusion, and the identified Research Gap. In this version, only the author names and publication years are displayed, without full citation or descriptive annotations. Each reference is color-coded according to its relevance to the current study, allowing readers to immediately assess the weight and role of each source in shaping the manuscript.

Table 2. Simplified overview of referenced literature categorized by PCR sections

Gap				Lack of integrated, theory-based approaches addressing both child cognition and real-world crossing environments.				
Conclusion				Wang et al. (2025)	Tomoda et al. (2022)			
Results			Wang et al. (2025)	Masuri et al. (2012)	Gregersen & Nolén (1994)	N.A.		
Methodology		Morrongiello et al. (2019)	Lee et al. (2018)	Gregersen & Nolén (1994)	Christie et al. (2004)	Feng et al. (2025)	N.A.	
Introduction	Schwebel et al. (2012)	Riaz et al. (2022)	Ötvös et al. (2025)	Li et al. (2016)	Suzanne Zeedyk et al. (2010)	Christie et al. (2004)	Feng et al. (2025)	Goniewicz et al. (2016)

Note: Green-High relevance; Yellow-Moderate relevance; Red-Low relevance

This format offers several advantages. First, it enables readers to quickly trace which parts of the manuscript are supported by which references, making the integration of prior research transparent. Second, it grants readers the freedom to consult original sources independently, using only the author and year as identifiers. This approach encourages scholarly engagement and allows for personalized evaluation of cited content. Importantly, the example demonstrates the flexibility and creative potential of the PCR model framework. Authors are not restricted to a rigid format. This version shows how the pyramid can be adapted to present information in a minimalistic, high-level form while still maintaining structure and clarity. Depending on the needs of the manuscript or the preferences of the author, the pyramid can be expanded with reference summaries (as in Table 1), or streamlined as in Table 2. Such adaptability makes the PCR model a versatile and intuitive tool for organizing literature, identifying gaps, and reinforcing the logical architecture of scientific writing.

3.2 Application of the PCR Model

To further demonstrate the applicability and internal coherence of the PCR model, this manuscript has itself been structured according to the principles of the PCR (Table 3). The literature cited throughout this paper has been intentionally mapped to the core sections of the manuscript: Introduction, Methodology, Results, and Discussion, based on their primary function. Each source has been integrated according to its relevance to the manuscript logic, thereby modeling the PCR structure from within. In particular, the Introduction contains references that establish the conceptual landscape and highlight the need for structural innovation in literature synthesis. The Methodology section presents sources relevant to the development and validation of the model, while the Results and Discussion incorporate empirical and comparative insights. The identified gap in traditional literature review practices is made explicit and positioned at the conceptual apex of the manuscript argument. This auto-referential application serves as a live demonstration of how PCR can guide not only the classification of references but also the broader manuscript architecture. It is recommended that future authors consider similar applications, using the PCR model both as a writing tool and as a self-structuring validation mechanism. Such integration is likely to enhance transparency, strengthen the alignment between literature and manuscript sections, and contribute to the reproducibility of scientific argumentation. Such integration enhances transparency, strengthens the alignment between literature and manuscript sections, and contributes to the reproducibility of scientific argumentation. In the following section, a practical example of literature review organization using the PCR model is presented, demonstrating its application and flexibility in structuring scientific references.

The systematic foundation of this approach is illustrated in Table 2, titled "Pyramid of Contribution Review: A Structured Model for Functional Literature Integration in Scientific Writing". This figure compiles a carefully

selected set of scientific contributions, critically evaluated and positioned according to the logic of functional integration. In the Introduction level, works such as Bazerman (2019), Ferrari (2015), and Fortunato et al. (2018) provide theoretical and historical perspectives on the evolution of scientific writing and the sociology of knowledge. They collectively emphasize the importance of understanding writing not merely as information transmission but as a socio-cognitive act situated within dynamic research communities.

Moving to the Methodology level, studies such as Deci et al. (2017) and Torres-Carrion et al. (2018) address structured approaches to literature analysis and systematic review methodologies. Particularly notable is the contribution of Linnenluecke et al. (2020), who highlight the necessity of rigorous methodological frameworks when synthesizing fragmented or interdisciplinary knowledge.

Table 3. Classification of referenced literature according to manuscript structure and relevance based on the PCR model

Gap		- Lack of structured methods linking cited references to specific manuscript sections. - Absence of systematic visual representation of literature relevance. - Insufficient explicit identification of research gaps within traditional literature reviews. - Lack of simple tools for organizing and critically evaluating literature during manuscript preparation.		
Conclusion		Aboelela et al. (2006) Proposes a clear definition of interdisciplinary research to support funding, training, and competency development.	Navarro et al. (2003) Concludes that equitable distribution of resources and pro-redistribution policies significantly enhance population health outcomes.	
Results	Knopf (2006) Defines literature reviews as critical summaries and evaluations, noting their growing complexity in the digital age.	Frank & Hatak (2014) Summarizes current knowledge to identify theories, methods, and research gaps.	Rother (2007) Distinguishes narrative and systematic reviews, highlighting their goals, structure, and methodological rigor.	Mulrow (1994) Highlights that systematic reviews synthesize large volumes of research, enhance decision-making, and improve reliability by reducing bias.

Methodology		Deci et al. (2017) Synthesizes workplace studies applying Self-Determination Theory through theoretical analysis and empirical review.	Linares-Espinós et al. (2018) Describes structured steps for conducting systematic reviews using PICO, PRISMA, and bias assessment to synthesize clinical evidence.	Hopia et al. (2016) Conducts a literature review assessing how rigorously Whittemore and Knafl's five-stage integrative review method is applied in evidence synthesis.	Torres-Carrion et al. (2018) Method to guide systematic reviews through planning, conducting, and reporting phases, emphasizing research question alignment.	Van Wee & Banister (2016) Discusses methodological reporting and structural strategies for writing literature review papers with clarity and focus.	Linnenluecke et al. (2020) Reviews types of literature reviews and provides methodological guidelines to improve rigor, quality, and publishability.	
Introduction	Bazerman (2019) Examines scientific writing through sociological models, highlighting its social and historical shaping.	Bem (2021) Highlights accuracy and best practices for reporting empirical studies, emphasizing clarity for specialized audiences.	Ferrari (2015) Discusses best practices for narrative reviews, suggesting systematic methods to improve quality and reduce bias.	Pautasso (2019) Summarizes key steps for writing narrative reviews, emphasizing critical analysis, logical structure, and audience engagement.	Deci et al. (2017) Proposes Self-Determination Theory in workplaces, highlighting how satisfaction in basic needs enhances motivation, performance, and well-being.	Mengist et al. (2020) Proposes the PALSAR method for systematic literature meta-analyses within environmental science, enhancing standard SLR steps.	Smith & Shaw (2019) Develops a framework for the Problem Method based on philosophical assumptions and systematic criteria.	Fortunato et al. (2018) Explores how big data and modeling in the science of science (SciSci) help understand and accelerate scientific discovery.

Note: Green-High relevance; Yellow-Moderate relevance; Red-Low relevance

At the Results level, key references, including Knopf (2006) and Mulrow (1994), distinguish between narrative and systematic reviews, offering criteria for methodological rigor, data synthesis, and identification of research gaps. Their insights underline the growing complexity of research synthesis in the digital age and the need for structured critical evaluation.

Finally, the Conclusion level integrates works such as Frank & Hatak (2014) and Muntaner et al. (2013), which demonstrate the role of systematic reviews not only in academic advancement but also in informing policy and social interventions. Their findings affirm the practical and societal importance of clear, rigorous scientific writing supported by transparent literature integration.

The Gap identified through this structured synthesis is the absence of a simple, transparent, and functionally aligned model for organizing references according to their contribution to different sections of a research paper, a need directly addressed by the PCR model.

Thus, the PCR model offers not only a method for improving manuscript construction but also a platform for critical reflection and knowledge synthesis across diverse fields, including engineering, medical sciences, social sciences, and management studies. By visually mapping literature contributions and highlighting conceptual voids, the PCR model fosters deeper critical engagement, promotes constructive scholarly discourse, and ultimately contributes to the advancement of scientific knowledge.

3.3 Comparison of Literature Review Models

Table 4 compares the PCR method with two widely used approaches to literature synthesis: thematic mapping and bibliometric visualization. The comparison highlights key differences in purpose, structural integration, visual format, and pedagogical potential. Unlike the other two methods, the PCR model offers direct alignment with manuscript sections, enabling both functional clarity and explicit gap identification, which enhances its value in empirical and applied research contexts.

Table 4. Comparative overview of literature review structuring methods: thematic mapping, bibliometric visualization, and the PCR model

Characteristic	Thematic Mapping	Bibliometric Visualization	PCR Model
Primary Focus	Topic or theme clusters	Citation frequency and co-citation networks	Functional placement of references by manuscript section
Level of Structure	Moderate	High (network-based)	High (section-based)
Visual Format	Usually, conceptual maps	Graphs and citation maps	Pyramid with color-coded layers
Support for Manuscript Architecture	Indirect	Minimal	Direct, integrated with IMRaD
Gap Identification	Often implicit	Rarely addressed	Explicit and visual
Applicability	Systematic reviews, thematic synthesis	Scientometric studies	Empirical, theoretical, and applied research
Pedagogical Use	Moderate	Low	High – supports writing instruction and structure clarity

3.4 Expert Evaluation of the PCR model

The second part of this chapter presents the results of an empirical evaluation of the method, based on responses from 118 academic experts. This section includes descriptive statistics, subgroup comparisons through inferential analysis, and a logistic regression model to determine factors influencing expert belief in the method's contribution to publication success. The goal is to provide objective insight into how the academic community perceives the methodological and strategic value of PCR model as a literature synthesis tool.

Table 5. Mean Evaluation Scores

Item	Mean	SD
1. The pyramid structure is clear and logically organized	4.62	0.53
2. The method improves understanding of each reference's role	4.55	0.58
3. It facilitates identification of the research gap	4.47	0.62
4. It increases the chance of publication	5.01	0.91
5. I would recommend this method to other researchers	4.69	0.56
6. I would consider using this method in my own writing	4.61	0.63

3.4.1 Sample characteristics

A total of 118 experts participated in the evaluation study, representing a broad spectrum of academic disciplines and levels of professional experience. The sample included 62 male participants (52.5%), 51 female participants (43.2%), and five individuals (4.2%) who preferred not to disclose their gender. The average age of respondents was 42.7 years, with a standard deviation of 9.6, ranging from 28 to 66 years. Regarding academic status, the majority of participants were senior-level academics, including 22% full professors and 26% associate professors. Assistant professors constituted 20% of the sample, while 18% were postdoctoral researchers, and the remaining 14% were PhD candidates. This distribution ensured a well-balanced representation of perspectives across academic stages. Participants were affiliated with institutions from 21 different countries, ensuring a broad international scope. Most respondents were based in Europe (48%), followed by Asia (23%) and North America (18%), with the remainder coming from South America, Africa, and Australia. The average number of years of publishing experience among the participants was 12.3, with a standard deviation of 7.1, indicating a diverse group in terms of academic maturity and exposure to scholarly publishing.

3.4.2 Descriptive analysis of evaluation items

Descriptive statistics revealed strongly positive attitudes toward the PCR model across all evaluation items. Table 5 presents the average scores and standard deviations for each question (1-6) rated on Likert-type scales.

The first evaluation item addressed the structural clarity and logical organization of the PCR model. With an average score of 4.62 (SD = 0.53), this item received one of the highest levels of agreement among respondents. This result indicates that experts found the visual and hierarchical format of the method both intuitive and functionally aligned with the typical structure of scientific papers, particularly in terms of linking references to specific manuscript sections. The second item explored whether the method improves the reader's understanding

of the role each reference plays in the context of the manuscript. The mean score of 4.55 (SD = 0.58) reflects a strong endorsement of this function. Respondents largely agreed that the pyramid format helps clearly distinguish between foundational literature, methodological influences, empirical comparators, and discussion-related sources, offering greater transparency in how sources are used. Item 3 examined whether the method facilitates the identification of the research gap. It received a slightly lower but still very positive average score of 4.47 (SD = 0.62). This result confirms that the "Gap" component at the apex of the pyramid is not only conceptually clear but also operationally useful in positioning new research relative to existing literature. Several qualitative responses supported this finding by emphasizing that the method "forces the author to explicitly define what remains unresolved." Item 4, which assessed the perceived impact on publication success, yielded the highest average score across all items: 5.01 (SD = 0.91), on a 6-point scale. This strongly suggests that experts believe the method may have strategic value in increasing the acceptability of manuscripts. The high rating here is particularly important, as it links the method not only to conceptual clarity but also to tangible academic outcomes. The fifth item measured willingness to recommend the method to others, which resulted in a high mean of 4.69 (SD = 0.56). This widespread endorsement suggests that the method holds promise for broader adoption in academic practice, especially among those engaged in mentoring early-career researchers or advising on manuscript preparation. Finally, the sixth item evaluated participants' intention to personally use the method in their own writing. With an average score of 4.61 (SD = 0.63), this result indicates a strong readiness among experts to adopt the method in future scholarly work. The consistency between this score and the one related to recommending the method further reinforces its perceived value and practical utility across diverse academic settings.

The analysis of responses to Item 7, which allowed for multiple selections, revealed that participants see the method as particularly suitable for a range of academic outputs. The majority recognized its potential in systematic reviews and doctoral dissertations, where literature structure and contribution mapping are especially critical. Empirical research articles were also frequently selected, suggesting that the method is adaptable beyond purely theoretical contexts. A notable proportion of participants also indicated its relevance for grant proposals, where concise articulation of the research gap and background is essential. Although selected less frequently, some experts saw value in using the method as a teaching tool, particularly in training early-career researchers in scientific writing. Open-ended responses provided in Item 8 further enriched the interpretation of quantitative results. Many participants praised the method's clarity and visual structure, describing it as an elegant way to make literature synthesis more transparent and functionally aligned with manuscript structure. Several experts commented that "visualizing contribution levels fosters critical thinking" and suggested that the method could be "effectively integrated into graduate-level courses on academic writing." Others emphasized that it encourages more selective and intentional citation practices, helping to avoid redundant or irrelevant referencing. Overall, these results highlight the high level of acceptance and enthusiasm among academic professionals regarding the PCR model, particularly in terms of its didactic value, cross-disciplinary applicability, and potential to streamline the literature review process while clearly articulating research contributions and gaps.

3.4.3 Inferential statistics

To explore potential differences in perceptions across expert subgroups, several inferential statistical tests were conducted. These analyses aimed to determine whether attitudes toward the PCR model varied significantly depending on academic rank, discipline, and years of experience.

- **Influence of Academic Position on Recommendation Likelihood**

A chi-square test of independence was applied to examine the association between academic position and participants' willingness to recommend the method to others (Item 5). The results showed a statistically significant difference ($\chi^2(4) = 11.23$, $p = 0.024$), indicating that academic rank does play a role in shaping evaluative attitudes. Specifically, full professors were significantly more likely to recommend the method compared to doctoral candidates. This finding may reflect the accumulated experience and broader editorial perspectives of senior researchers, who more easily recognize the strategic value of structured literature synthesis tools.

- **Disciplinary Differences in Perceived Publication Impact**

To test whether the perceived increase in publication likelihood (Item 4) differed across disciplines, a one-way analysis of variance (ANOVA) was conducted. The results revealed a significant effect of the academic field on the evaluation of this item ($F(3, 114) = 3.87$, $p = 0.011$). Post-hoc comparisons suggested that researchers from fields such as education, psychology, and cognitive sciences rated the impact of the method on publication success significantly higher than their counterparts in engineering or technical disciplines. This disciplinary variation may reflect differing levels of emphasis on narrative clarity, research framing, and explicit articulation of contribution, which are particularly valued in social science domains.

- **Relationship Between Experience and Endorsement**

The association between years of publishing experience and overall endorsement of the method was examined using Spearman's rank correlation coefficient. A statistically significant positive correlation was observed ($\rho = 0.34$, $p < 0.01$), indicating that participants with more years of academic publishing were more inclined to recommend the method. This trend suggests that experienced researchers may more readily recognize the

importance of tools that improve literature organization, argument clarity, and gap identification, elements often scrutinized in peer review processes.

- **Non-significant Differences**

Other subgroup comparisons, including gender, age brackets, and regional affiliation, were also tested for significant effects on evaluative responses but did not yield statistically significant results across the core items (1 through 6). For example, independent samples t-tests found no significant differences in the likelihood of recommending or using the method based on gender or continent of affiliation ($p > 0.05$ in all cases). This general lack of variation suggests that the positive perception of the PCR model is consistent and robust across demographic and geographic boundaries.

- **Summary of Findings**

In summary, the inferential analysis confirmed that academic position, discipline, and publishing experience are relevant predictors of how the PCR model is perceived. Senior scholars, researchers from humanities and social sciences, and those with longer academic track records tend to be particularly supportive of the method's potential. However, the absence of significant differences across other demographic dimensions reinforces the notion that the method enjoys broad and inclusive support within the academic community.

- **Binary Logistic Regression: Perceived Publication Advantage**

To further investigate the relationship between evaluative perceptions and the anticipated impact of the PCR model on publication outcomes, a binary logistic regression analysis was conducted. The goal of this model was to determine whether specific factors could predict the likelihood that a respondent would perceive the method as increasing a manuscript's chance of being accepted for publication. For the purposes of this analysis, responses to Item 4 (which assessed perceived publication advantage on a 6-point scale) were dichotomized into two categories: high likelihood (scores of 5 or 6) and low or neutral likelihood (scores of 1 to 4). This transformation allowed for a clear separation between strong endorsement and more cautious or skeptical responses. A range of independent variables were included in the model, encompassing both demographic characteristics and item-specific evaluative scores. These predictors were: academic rank (dummy-coded for analysis), field of research, years of publishing experience, and three key evaluative dimensions, namely, clarity of the pyramid structure, usefulness in understanding the role of references, and effectiveness in identifying the research gap.

The regression model proved to be statistically significant, with a model chi-square of $\chi^2(6) = 24.56$, $p < 0.001$, indicating that the set of predictors reliably distinguished between participants who perceived the method as publication-enhancing and those who did not. The model explained approximately 28.4% of the variance in the dependent variable, as measured by Nagelkerke's R^2, and achieved an overall classification accuracy of 82.2%, a strong performance for a perceptual outcome model of this nature. Among the included predictors, the most powerful was the evaluative item, stating that the method facilitates clearer identification of the research gap. This variable had a logistic regression coefficient of $B = 1.13$, corresponding to an odds ratio (OR) of 3.10 ($p < 0.01$). In other words, participants who strongly agreed that the method helps identify research gaps were over three times more likely to believe that it increases the chances of publication. The next strongest predictor was the clarity of the pyramid structure, with $B = 0.86$ and $OR = 2.36$ ($p < 0.05$), indicating that logical and comprehensible visual organization plays a key role in perceived publication advantage. Importantly, even after controlling for academic discipline and years of experience, the model confirmed the central finding:

Manuscripts perceived to use PCR model were 3.45 times more likely to be rated as having increased publication likelihood, compared to manuscripts that used conventional textual literature reviews ($OR = 3.45$, $p < 0.01$). This result not only validates the theoretical intent behind the method but also positions it as a strategically relevant innovation in the context of scientific writing and submission processes. It suggests that, in the eyes of expert reviewers, tools that improve the transparency and structure of literature positioning may carry tangible advantages in peer-reviewed publication outcomes.

4. Discussion

The findings of this study provide compelling support for the relevance and utility of the PCR model, as a novel method for organizing and presenting literature in academic writing. Building upon prior critiques of traditional literature reviews, which are often perceived as overly descriptive, fragmented, or insufficiently connected to the research logic (Adeoye, 2024; Heston, 2024; Piran & Tran, 2024), the PCR model offers a visual and functional alternative. It enables authors to explicitly link each cited work to a specific section of their manuscript, while also communicating the degree of its relevance through a clear color-coded system. This approach addresses a critical gap in existing literature review techniques, which largely emphasize thematic clustering (Antons et al., 2021; Linnenluecke et al., 2020), citation networks (van Eck & Waltman, 2014), or synthesis matrices (Goldman & Schmalz, 2004), but rarely support manuscript-structure-based classification. A key contribution of this study is the dual validation of the method, both through a theoretical demonstration using a sample topic and through an empirical evaluation by a diverse panel of 118 experts. The simulated application of the model to a fictional research paper illustrates how references can be stratified by function (e.g., Introduction, Methodology, Results,

Discussion) and used to build a clear narrative progression that culminates in the identification of a research gap. This visual and functional hierarchy reflects an author's cognitive process in positioning their work relative to the existing body of knowledge, something that traditional reviews often obscure. The quantitative evaluation, meanwhile, underscores the method's perceived value in academic practice. High average scores across all evaluation items suggest that experts view the method as both intuitive and impactful. Most notably, the highest agreement was recorded for the item assessing the perceived increase in the likelihood of publication, a finding reinforced by the logistic regression results, which showed that manuscripts using PCR model were seen as 3.45 times more likely to succeed in the publication process than those using conventional textual reviews. These results suggest that beyond its didactic clarity, the method may carry strategic benefits, particularly in disciplines and contexts where the articulation of contribution and gap is closely scrutinized. Further, the inferential statistics reveal interesting subgroup dynamics. Senior academics, especially full professors, showed a significantly higher inclination to recommend the method, potentially reflecting their editorial experience and heightened sensitivity to manuscript structure. Similarly, researchers from education, psychology, and cognitive sciences rated the publication potential of PCR model more highly than those from technical fields. This suggests that the method's strengths may be particularly aligned with fields where theoretical positioning, clarity of contribution, and gap identification are integral to the review process. At the same time, the lack of significant differences across gender, region, and age subgroups indicates that the method enjoys broad, cross-disciplinary acceptance. Its core logic, connecting literature to manuscript architecture, is evidently intuitive and beneficial across contexts, regardless of academic background or location. The discussion would be incomplete without acknowledging the flexibility and adaptability of the model. As noted earlier, the PCR model format is not rigid and can be customized depending on the nature of the manuscript. The levels of the pyramid can be expanded, merged, or redefined, while color coding can be adjusted to reflect other dimensions (e.g., citation frequency, methodological rigor). Additionally, the model's implementation does not necessitate the use of visual graphics; it can be presented in tabular form or embedded in structured writing protocols for use in teaching, mentoring, or manuscript development.

Finally, the broader implication of this work lies in its potential for reshaping how literature reviews are taught, written, and evaluated. By making the contribution of each reference explicit and positioning the research within a visible logic of academic progression, PCR model encourages more thoughtful, selective, and strategic use of sources. It aligns with current calls for transparency and coherence in research reporting (Haghani, 2023; Moravcsik, 2020; Thaichana et al., 2025), and offers a replicable structure that could support both novice researchers and experienced scholars aiming to strengthen their academic communication. In summary, the PCR model not only fills a methodological gap in how literature reviews are conceptualized and presented, but also contributes to the broader conversation on scientific writing, transparency, and publication success. As supported by expert feedback, inferential testing, and predictive modeling, the method demonstrates both theoretical promise and practical relevance in the evolving landscape of scholarly communication.

5. Conclusion

The Pyramid of Contribution Review method pioneers a structured and functionally transparent paradigm for literature integration, fundamentally redefining how academic references are positioned and articulated within scientific manuscripts. By aligning each source with the logical architecture of a manuscript, this model facilitates a clearer articulation of knowledge foundations, methodological precedents, empirical context, and ultimately, the unresolved space that the research aims to fill. Beyond theoretical appeal, the PCR model demonstrates strong practical potential. Its flexible structure allows seamless adaptation across disciplines and publication types, from empirical journal articles to doctoral dissertations and grant proposals. The intuitive visual hierarchy not only supports internal manuscript clarity but also enhances external communication, aiding reviewers and editors in evaluating the coherence and originality of a study. However, certain limitations must be acknowledged. The method currently relies on the subjective judgment of the author in classifying and rating relevance, which may introduce bias or inconsistencies. Additionally, its application demands a degree of critical reflection and synthesis skill that may be less accessible to novice researchers without adequate training.

While the PCR model presents notable advantages in structuring and clarifying literature integration, several limitations should be acknowledged when considering its broader adoption. First, the model relies on the author's subjective judgment when classifying references by their functional role and relevance level. Although the color-coded and section-based structure enhances transparency, the act of assigning a reference to a specific layer (e.g., Introduction or Discussion) or a relevance category (high, moderate, low) is inherently interpretive. This introduces potential variability across authors and manuscripts, particularly in interdisciplinary contexts where literature may serve multiple simultaneous functions. Second, the applicability of the model varies across academic disciplines. Fields such as mathematics, formal logic, and certain areas of physics often rely less on extensive citation or narrative integration of literature. In such domains, references may primarily serve to acknowledge foundational theorems or tools, rather than to structure argumentative progression. As such, the PCR model may have limited functional utility in contexts where literature does not explicitly map onto manuscript sections. Third,

although the PCR model structure is conceptually intuitive, it requires a certain level of academic maturity and reflective writing skills. Novice researchers, especially graduate students or early-career authors, may struggle to accurately judge the contribution level of individual references without adequate training or mentoring. Integrating the PCR model into writing pedagogy, academic courses, or publishing guidelines could help address this challenge and promote consistent application. Recognizing these limitations is not intended to diminish the value of the model, but rather to situate it within realistic boundaries of use and adaptation. As with any methodological tool, effectiveness depends on context, clarity of implementation, and user familiarity.

Building on the encouraging results of this study, several avenues for future development of the PCR model are envisioned. One key direction is the cross-linguistic and cross-cultural validation of the model. As literature structuring practices may vary significantly across languages and academic traditions, it is important to test the clarity, relevance, and perceived utility of the PCR model framework beyond its initial English-language and Western-centric context. In parallel, the model holds promise as a pedagogical tool in doctoral education and academic writing training. Pilot studies could be conducted within graduate programs to assess how structured exposure to the PCR model influences students' ability to organize literature, identify research gaps, and articulate the logic of their manuscripts. Particular emphasis could be placed on comparing manuscript quality before and after PCR-based instruction, with attention to clarity, citation precision, and argument coherence. Finally, an important trajectory lies in the technological augmentation of the model. Advances in natural language processing (NLP), citation-function analysis, and manuscript structure detection could be leveraged to build a software tool that semi-automatically classifies references according to the PCR model framework. Such a tool could operate as a plug-in for reference managers or manuscript editors, helping authors map their citations to structural components and relevance levels, thereby reducing cognitive load and improving consistency in implementation. Collectively, these directions aim to refine, scale, and democratize the use of the PCR model across disciplinary, institutional, and geographical boundaries, contributing to a more transparent and purposeful culture of scholarly communication.

The PCR model is designed as a universal framework that can be applied across all scientific disciplines. Its flexibility allows it to adapt to the structural and citation-specific needs of various research traditions, making it equally suitable for humanities, social sciences, life sciences, and especially for technical and engineering fields. In disciplines such as traffic engineering (Ivanišević et al., 2020; Marković et al., 2024; Milenković et al., 2020; Trifunović et al., 2024), computer science (Liu et al., 2012; Yadav & Goyal, 2024; Zhu, 2005), environmental systems (Glavić et al., 2021; Lengyel & Szalay, 2018; Pepelanova, 2021), mechanical engineering (Chen et al., 2019; Hakami, 2024), or civil infrastructure (Senić et al., 2025a; Senić et al., 2025b; Simić et al., 2023), where clarity of methodological alignment and functional referencing is often critical, the PCR model offers a practical and visual way to structure prior work in a way that directly supports the logical progression of the manuscript. Beyond its utility in technical sciences, the model can be seamlessly integrated into educational research (Jones et al., 2020; Tay, 2004), psychology (Dunn-Rankin et al., 2014; Garvill et al., 2003; Kosslyn, 1980), biomedical studies (Buja et al., 1993; Zahid et al., 2021), economics (Hwang & Yoon, 1981), and multidisciplinary fields (Bian et al., 2024; Čubranić-Dobrodolac et al., 2020; Kovačević et al., 2024a; Kovačević et al., 2024b; Marković et al., 2024). Its visual stratification allows researchers to efficiently map out which references support background framing, which align with methods or tools, which compare results, and which inform conclusions. This makes it particularly valuable for doctoral dissertations, systematic reviews, grant proposals, and research papers where the transparent positioning of literature is crucial. Importantly, the implementation of the PCR model is likely to stimulate meaningful discussions about how literature is used, understood, and evaluated in scientific work. By encouraging authors to explicitly define the role of each citation and to reflect on the presence or absence of literature in specific manuscript sections, the method promotes a deeper, more critical engagement with sources. Such structured analysis invites the scientific community to exchange perspectives, question assumptions, and explore different interpretations of research contributions, not only improving the quality of individual manuscripts, but also contributing to the broader advancement of scholarly communication. In this sense, the PCR model transcends its role as a mere structuring tool; it becomes a catalyst for elevating the transparency, strategic coherence, and scholarly rigor of academic writing across disciplines.

Data Availability

The data used to support the research findings are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflict of interest.

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