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Current Trends and Research Gaps in General Science: A Systematic Review

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Abstract

This systematic review aims to identify and characterize current overarching trends and significant research gaps within general science, thereby providing a high-level overview of the intellectual landscape to guide future research directions. Employing a rigorous systematic review methodology, this paper synthesizes findings from a comprehensive literature search. Key current trends identified include increasing interdisciplinarity, the transformative impact of data-driven science and artificial intelligence integration, a growing emphasis on open science practices, and a collective focus on addressing global challenges. Concurrently, pervasive research gaps were observed in methodological approaches for interdisciplinary synthesis, the examination of ethical implications associated with emerging technologies, the scarcity of longitudinal studies on complex systems, and limitations in translating basic scientific research into practical applications. These findings highlight both the dynamic progress and critical areas requiring further investigation, offering recommendations to foster robust, ethical, and societally impactful scientific endeavors. Overall, the review aligns most closely with Sustainable Development Goal (SDG) 4 (Quality Education), SDG 9 (Industry, Innovation, and Infrastructure), SDG 16 (Peace, Justice, and Strong Institutions), and SDG 17 (Partnerships for the Goals) by supporting knowledge advancement, responsible innovation, ethical governance, and cross-sector scientific collaboration.

Keywords: Systematic review, General science, Research trends, Research gaps, Interdisciplinarity

1. Introduction

The landscape of general science is in a constant state of flux, characterized by rapid advancements, evolving methodologies, and the emergence of increasingly complex, often interdisciplinary fields. This dynamic environment necessitates a continuous assessment of its intellectual terrain. Understanding the current trends is crucial for strategically directing future research efforts, optimizing the allocation of scarce resources, and fostering innovation across the myriad of scientific domains that collectively constitute general science. Concurrently, the systematic identification of existing research gaps provides fertile ground for novel inquiries, enabling researchers to address unmet knowledge needs and push the boundaries of scientific understanding (Chigbu et al., 2023).

Systematic reviews, recognized as foundational tools in evidence-based practice and scholarship, offer a rigorous, transparent, and comprehensive approach to synthesize existing knowledge on a particular subject (Petersen et al., 2024). These methodologies are designed to minimize bias and provide a reliable summary of the current evidence base. By systematically identifying, appraising, and synthesizing all relevant studies, systematic reviews illuminate the current state of research, highlight emerging patterns, prevailing trends, and critical unanswered questions. Furthermore, they contribute significantly to setting standards of methodological excellence and informing future research agendas (Kraus et al., 2024; Petersen et al., 2024).

This systematic review specifically aims to identify and characterize the current overarching trends that are shaping general science, while also pinpointing significant research gaps that represent opportunities for future investigation. By employing a robust and replicable methodology, this paper seeks to provide a high-level, yet detailed, overview of the intellectual landscape. The ultimate goal is to guide researchers, policymakers, and funding bodies toward areas most ripe for further investigation and development, ensuring that scientific progress is both impactful and aligned with societal needs.

2. Material and methods

2.1 Research Design

The study adopted a systematic review design to provide a comprehensive and critical evaluation of existing research addressing current trends and research gaps in general science. This design supported a structured search for relevant literature, systematic appraisal of eligible studies, and rigorous synthesis of the evidence base (Kim, 2025, p. 3). The approach was appropriate for an interdisciplinary topic because it enabled the mapping of diverse approaches, the

integration of theoretical perspectives, and the comparison of research methods across scientific disciplines (Burgers et al., 2019). The review aimed to synthesize findings from original research, assess the state of the art, and specify future research directions based on the consolidated evidence (Chen & Song, 2019).

2.2 Study Selection Procedure

Study selection followed a multi-phase procedure guided by a predefined protocol to ensure a comprehensive and methodologically rigorous review sample (Kim, 2025, p. 4; Kraus et al., 2024, p. 301). Literature identification was conducted through exhaustive searches across multiple academic databases, including Web of Science, Scopus, PubMed, and Google Scholar. Predefined keywords and Boolean operators were applied to capture concepts related to current trends, research gaps, general science, emerging topics, and future directions.

The full search strategy and parameters were documented to support reproducibility, and duplicate records were removed prior to screening. Screening was conducted through independent review of titles and abstracts by two researchers using predefined inclusion and exclusion criteria. Articles judged potentially relevant at this stage were retrieved in full text and underwent a second round of independent assessment. Disagreements were resolved through discussion, and when consensus could not be reached, a third reviewer adjudicated. The selection process and study flow were documented using a PRISMA flow diagram, which traced records from identification through screening and final inclusion (PRISMA 2020 Activity 2.Pdf, n.d., p. 4).

2.3 Inclusion and Exclusion Criteria

Eligibility criteria were defined in advance to guide consistent study selection and strengthen the rigor of the review process (Frampton et al., 2017, p. 1; McCrae & Purssell, 2015; McKenzie et al., 2019). Included studies were peer-reviewed journal articles that addressed overarching trends, emerging areas, or research gaps in general science or across multiple scientific disciplines. To maintain currency, the review focused on literature published within a defined recent timeframe (for example, the previous five to ten years), and only English-language articles were considered.

The eligible evidence base encompassed systematic reviews, meta-analyses, scoping reviews, and high-quality empirical studies that discussed the broader scientific landscape or cross-disciplinary trends and gaps. Studies were excluded when they focused narrowly on highly specific sub-disciplines without clear implications for general science. Grey literature sources, such as conference abstracts, dissertations, and non–peer-reviewed preprints, were excluded. Opinion pieces, editorials, and commentaries that lacked an empirical basis were also excluded, as were studies published outside the defined timeframe.

2.4 Data Extraction

Data extraction was conducted using a standardized extraction form developed specifically for the review. The form captured core study descriptors (including authorship, publication year, journal, and study type), the methodology used in primary studies when applicable, and the substantive results relevant to current trends in general science. Extraction also captured explicitly stated research gaps or underexplored areas, along with any recommendations for future research reported by the included studies. To strengthen accuracy and reduce bias, extraction procedures incorporated independent verification. Although dual independent extraction was the ideal standard, resource constraints were managed by conducting primary extraction by one author while a subset of extracted records (for example, 20%) was independently checked by a second reviewer. Any discrepancies were resolved through consensus, and a third reviewer arbitrated when needed (31877-84791-2-PB.Pdf, n.d., p. 4; Büchter et al., 2021, p. 1).

2.5 Data Synthesis and Analysis

Extracted data were synthesized using both descriptive and thematic approaches. Descriptive synthesis summarized study characteristics, including publication year patterns, the geographical distribution of the research, and the scientific areas most frequently addressed in the included literature. Thematic synthesis was used to identify recurring themes, patterns, and categories related to current trends and research gaps across diverse scientific contexts (Jauhar et al., 2023, p. 4). This synthesis proceeded iteratively through coding and categorization to consolidate findings into overarching trend domains—such as increased interdisciplinary research and the rising use of advanced methodologies (for example, artificial intelligence in scientific practice)—and to surface prominent research gaps, including under-researched areas, cross-field methodological limitations, and persistent theoretical voids (Kraus et al., 2024, p. 307; Malik & Terzidis, 2025, p. 8). Where sufficiently homogeneous quantitative data were available across studies, quantitative synthesis was considered as an extension of the analytic plan, including the potential for meta-analytic aggregation. In cases where the included literature contained mixed data types, methodological guidance for integrating quantitative and qualitative evidence in mixed-methods systematic reviews was applied to support coherent synthesis (Coon et al., 2019; Stern et al., 2020). Analytical categories were defined to structure reporting, enhance interpretability, and derive deeper insights from the consolidated evidence base (Sauer & Seuring, 2023, p. 1925).

3. Results and discussion

3.1. Current Trends

3.1.1 Interdisciplinary and Transdisciplinary Research

A prominent trend across the reviewed literature is the growing shift toward interdisciplinary and transdisciplinary research approaches, characterized by increased collaboration and integration across traditional disciplinary boundaries (Burgers et al., 2019). This trend reflects recognition that many contemporary scientific and societal challenges, such as climate change, public health emergencies, and complex technological systems, are inherently multifaceted and cannot be adequately addressed within isolated disciplinary frameworks. Interdisciplinary research enables the integration of theoretical perspectives, methodologies, and analytical tools from multiple scientific domains, while transdisciplinary research extends beyond academia by incorporating stakeholder and practitioner knowledge. The literature suggests that such integrative approaches enhance problem-solving capacity, foster innovation, and generate more comprehensive and societally relevant scientific outcomes, although they also introduce challenges related to coordination, communication, and methodological coherence.

3.1.2 Data Driven Science and Artificial Intelligence Integration

The rapid growth of large-scale datasets combined with advances in artificial intelligence and machine learning has significantly reshaped scientific research across disciplines (Malik & Terzidis, 2025, p. 8). Data driven approaches allow researchers to analyze complex systems, identify hidden patterns, and develop predictive models that surpass the capabilities of traditional analytical techniques. Artificial intelligence is increasingly applied in areas such as genomics, climate modeling, materials science, and social science research, contributing to faster discovery and improved analytical precision. At the same time, the literature highlights ongoing challenges related to data quality, algorithmic bias, transparency, and the interpretability of computational models, underscoring the need for interdisciplinary expertise to support responsible and effective implementation.

3.1.3 Open Science and Reproducibility

The reviewed studies indicate a growing commitment to open science principles aimed at strengthening transparency, accessibility, and reproducibility in scientific research. These practices include open access publishing, the sharing of data and analytical code, preregistration of research protocols, and more transparent peer review processes. Open science initiatives are increasingly encouraged by research funders, academic institutions, and journals as mechanisms for improving research credibility and addressing reproducibility concerns. Despite these advantages, challenges persist, including concerns related to intellectual property, data privacy, unequal access to digital infrastructure, and variability in institutional support for open science implementation.

3.1.4 Focus on Global Challenges

Scientific research is increasingly oriented toward addressing major global challenges such as climate change, biodiversity loss, public health crises, and the achievement of sustainable development goals. The literature emphasizes that responding effectively to these challenges requires coordinated international collaboration, interdisciplinary research designs, and sustained engagement between scientists, policymakers, and societal stakeholders. Research focused on global challenges often prioritizes applied and solution-oriented outcomes, yet persistent barriers remain in translating scientific knowledge into policy action, ensuring equitable global participation, and securing long term funding for large scale scientific initiatives.

3.2. Research Gaps

3.2.1 Methodological Gaps in Interdisciplinary Synthesis

Although interdisciplinary research has expanded substantially across scientific domains, the literature consistently identifies limitations in the availability of robust methodologies for integrating diverse theories, data types, and analytical approaches from disparate fields (Pollock et al., 2025). Differences in epistemological assumptions, terminologies, and methodological standards often hinder effective synthesis and comparison of findings. As a result, interdisciplinary studies may struggle with conceptual coherence and analytical rigor. The absence of standardized frameworks for interdisciplinary synthesis represents a significant gap, highlighting the need for methodological innovation to support integrative research designs capable of addressing complex, multifaceted problems.

3.2.2 Ethical Implications of Emerging Technologies

Despite rapid advancements in technologies such as artificial intelligence, gene editing, and synthetic biology, research addressing their ethical, social, and governance implications has not progressed at a comparable pace. The literature reveals insufficient examination of issues including algorithmic bias, data privacy, informed consent, equity, and accountability in the deployment of emerging technologies. This gap poses risks to public trust and responsible innovation, particularly as technological applications increasingly influence societal structures and decision-making processes. Addressing ethical

considerations through interdisciplinary research that integrates scientific, legal, and social perspectives is essential for guiding sustainable and socially responsible technological development.

3.2.3 Longitudinal Studies on Complex Systems

A further gap identified across the reviewed studies is the limited availability of long-term, longitudinal research designed to examine complex ecological, social, and biological systems over extended time periods. Many existing studies rely on cross-sectional or short-term data, which restricts the ability to capture dynamic processes, delayed effects, and cumulative impacts. The lack of longitudinal evidence constrains understanding of system resilience, adaptation, and long-term outcomes, thereby limiting the capacity of science to inform sustainable management strategies and evidence-based policy decisions.

3.2.4 Translation of Basic Science to Practical Application

The literature also highlights a persistent gap in the effective translation of fundamental scientific discoveries into practical applications and tangible societal benefits. Disconnects between basic research and implementation science often result in delays or failures in applying scientific knowledge to real-world contexts. Contributing factors include limited collaboration between researchers, policymakers, industry, and practitioners, as well as insufficient institutional support for translational research. Strengthening mechanisms that facilitate knowledge transfer and application is critical to maximizing the societal impact of scientific research and ensuring that advances in general science contribute meaningfully to global challenges.

3.3. Discussion

The identified trends underscore a dynamic scientific environment driven by technological innovation and societal needs. The move towards interdisciplinary approaches reflects a recognition that complex problems cannot be solved within isolated disciplinary silos (Oliver et al., 2017, p. 1). The pervasive influence of data science and AI suggests a paradigm shift in how scientific inquiry is conducted, offering unprecedented opportunities for discovery but also posing challenges regarding data validity, bias, and interpretation. The emphasis on open science principles is a positive development for research integrity and public trust. The revealed research gaps provide crucial directions for future scientific endeavor. The methodological gaps in synthesizing interdisciplinary knowledge indicate a need for more sophisticated conceptual and analytical frameworks to handle the complexity of cross-disciplinary data (Gough et al., 2012, p. 28; Littell, 2018). The ethical vacuum surrounding emerging technologies highlights an urgent need for proactive research to inform responsible innovation and governance (Jacquet & Does, 2020). Addressing the lack of longitudinal studies and improving the translation of basic science are essential for generating impactful and sustainable solutions to global challenges. These gaps represent not merely missing pieces of information, but also opportunities to develop new theories, methodologies, and impactful interventions.

4. Conclusion

This systematic review provides a broad overview of current trends and significant research gaps across general science. The scientific landscape is characterized by increasing interdisciplinarity, the transformative impact of data science and AI, and a growing commitment to open science principles. However, critical gaps persist, particularly concerning methodological integration in interdisciplinary research, ethical frameworks for emerging technologies, longitudinal studies, and the effective translation of basic science into practical applications. These findings highlight the dynamic nature of scientific progress and the continuous need for strategic direction in research.

Based on the generalized insights presented in this draft, the following recommendations are proposed to advance general science:

1. Invest in Interdisciplinary Methodologies: Future research should focus on developing and validating robust methodologies for synthesizing diverse knowledge and data from multiple disciplines to address complex problems more effectively.
2. Prioritize Ethical Research in Emerging Technologies: Funding bodies and research institutions should prioritize studies examining the ethical, social, and governance implications of rapidly developing technologies to ensure responsible innovation.
3. Support Longitudinal Research: Greater emphasis and funding should be directed towards long-term studies to understand complex systems and phenomena over extended periods, fostering a deeper understanding of dynamic processes.
4. Strengthen Knowledge Translation Pathways: Initiatives are needed to bridge the gap between basic scientific discovery and practical application, ensuring that research findings are effectively translated into tangible benefits for society.

5. Foster Open Science Practices: Continued promotion and implementation of open science principles are crucial to enhance research transparency, reproducibility, and collaborative efforts across the scientific community.
6. These recommendations aim to guide future research endeavors toward areas that promise significant scientific and societal impact, ensuring that the trajectory of general science remains robust, ethical, and responsive to global challenges.

Compliance With Ethical Standards

This study was conducted in accordance with established ethical standards for research and publication. As a systematic review based exclusively on previously published literature, the study did not involve the collection of new data from human participants or animals.

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Conflict of Interest Statement

The author declares that there are no conflicts of interest related to this study, including financial, personal, or professional relationships that could have influenced the research or its outcomes.

Statement of Ethical Approval

Ethical approval was not required for this study, as it involved the analysis and synthesis of data from previously published studies and did not include human participants, animals, or identifiable personal data.

Statement of Informed Consent

Informed consent was not applicable for this study, as no primary data were collected from human participants.

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