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"From Essential to Obsolete? The Evolution of Personal Communications in Academic Research and Citation Practices"

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Abstract

This study examines the evolving role of personal communications in academic research, tracing their historical significance and transformation in citation practices. Traditionally encompassing verbal exchanges, letters, and private correspondence, personal communications have long served as valuable but non-retrievable sources of knowledge. Using Scopus bibliometric data (1971–2024), this study investigates citation trends, disciplinary differences, and the growing impact of digitalization and artificial intelligence (AI) on informal scholarly exchanges. Findings indicate a decline in personal communication citations since the 2000s, likely due to the rise of formalized digital documentation, preprints, and AI-assisted research tools.

However, certain disciplines—such as Social Sciences and Computer Science—continue to rely heavily on personal communications, underscoring their ongoing relevance. The study also highlights a significant gap in citation standards, particularly in cases such as peer review reports, where proper attribution remains undefined. Furthermore, the potential classification of AI-generated insights as a form of personal communication raises new questions about citation ethics and research transparency. This pilot study contributes to bibliometric research by mapping the evolution of personal communications and advocating for standardized citation practices that reflect contemporary academic exchanges.

Introduction

The practice of citing personal communications holds a unique place in academic and scientific discourse. Historically, such communications have encompassed direct verbal exchanges, written correspondence (e.g., letters), and informal discussions, often occurring spontaneously at conferences or meetings. These exchanges, though not formally published, have played a crucial role in shaping scientific knowledge.

In the early modern period, correspondence between scholars served as a precursor to modern peer review, allowing researchers to share findings and experimental methods with colleagues or members of scientific societies (Gross et al., 2002). Even with the establishment of journal-based scholarly communication systems in the 17th century (Manten, 1980), informal exchanges remained vital to intellectual progress. Over time, these communications evolved, taking various forms, including direct verbal exchanges (such as personal interviews and discussions at academic events) and written correspondence (such as letters and emails). Letters, in particular, have been invaluable for historical research, while emails—though private—are

frequently cited as they serve as direct records of academic exchange (Cronin & Franks, 2006).

As scholarly communication systems developed, citation guidelines sought to standardize the inclusion of informal sources. Style guides such as the Chicago Manual of Style (first published in 1906) and the American Psychological Association (APA) Style Manual (introduced in 1929) began addressing how personal communications should be integrated into academic work. By the mid-20th century, APA explicitly instructed that personal communications—including unpublished letters, verbal exchanges, and private emails—should be cited only within the text and omitted from reference lists. This practice, formalized in the APA Style Manual's first edition (1952), remains in place today. Similarly, contemporary publishers, including Elsevier, specify that "unpublished results" and "personal communications" must adhere to standard reference styles, typically replacing publication dates with these terms (Day, Gastel, & Buchanan, 2012). This study focuses on the case of "personal communication," distinguishing it from "unpublished and negative results."

The nature of personal communication in academia has evolved significantly due to two major forces: the widespread adoption of the internet (Longo et al., 2009) and advancements in artificial intelligence (Dwivedi et al., 2021). Since the 1970s, the expansion of digital technologies and the growing emphasis on academic collaboration have led to an increase in multi-authored works (Brand et al., 2015). This, in turn, has broadened the concept of personal communication beyond one-on-one interactions to include diverse forms of exchange, such as emails, social media discussions, and online forums (Kousha, Thelwall, & Abdoli, 2012). These new communication channels blur the lines between formal publications and informal knowledge-sharing, raising questions about how such exchanges should be cited and acknowledged in scholarly work.

Two recent developments highlight the need to revisit citation practices for personal communications:

1. Plagiarism in Peer Review: A recent case of plagiarism during the review process of a scholarly manuscript exposed gaps in current citation standards. The plagiarized material, derived from a reviewer's comments, did not fit neatly within existing citation guidelines. While such content might be classified as personal communication, the absence of explicit standards creates ambiguity—especially in peer-review contexts (Ross-Hellauer, Deppe, & Schmidt, 2017).

2. The Role of AI in Academic Communication: The expansion of AI-generated content introduces new challenges in citation norms. A recent study (Gorraiz, 2025) examined the role of AI tools (e.g., ChatGPT) in academic research, particularly investigating whether they are recognized as authors or co-authors and how their contributions are cited across disciplines. Given that AI-generated outputs often function as sources of information—providing insights that are not directly retrievable—there is increasing interest in contextualizing AI citations within the broader framework of personal communications (Haustein et al., 2023).

Traditionally, personal communications have facilitated scholarly exchange by allowing researchers to share insights, theories, and unpublished data through

informal channels such as correspondence, interviews, and discussions. AI-generated outputs, which provide non-retrievable but influential knowledge, could be seen as analogous to these traditional forms of exchange. However, citation practices for AI remain inconsistent and largely unstandardized. This raises important questions: Should AI-generated insights be classified under personal communications? If expert discussions and peer exchanges qualify as valid informal sources, could AI outputs be acknowledged in the same way? As academic communication becomes increasingly structured, will AI tools replace traditional human-mediated informal exchanges, reshaping the landscape of personal communications?

Objective of the Study

While research has extensively examined citation patterns, co-authorship dynamics, and academic communication, the practice of citing *personal communications* remains underexplored in bibliometric studies. This paper aims to fill this gap by investigating the evolution of personal communication citations in scientific literature and examining their representation in bibliometric databases.

Research Questions

1. How are personal communications cited in scientific literature? 'This question explores if personal communications are cited in the reference lists or not,

2. Do bibliometric databases track personal communications in citations? Major databases like Web of Science and Scopus are essential tools for tracking citations, but do they accurately capture personal communications? Given the lack of standardization in citing these sources, this study investigates whether and how they can be identified and analyzed.

3. How have citations of personal communications evolved over the past decades? This question examines historical trends, focusing on how digitalization and the rise of online platforms (emails, blogs, social media) have impacted their citation. Has the increased accessibility of digital communications led to greater or lesser reliance on personal communications, and how have citation practices adapted?

4. In which academic fields are personal communications most commonly cited? This question aims to identify the disciplines where personal communications are frequently cited. Are they more prevalent in social sciences, humanities, or STEM fields?

By mapping the historical development of personal communication citations, this first pilot study aims to establish a foundation for understanding their current role and the challenges posed by emerging technologies. Examining the intersection of AI and personal communications will provide valuable insights into how informal knowledge-sharing is evolving in response to technological advancements and shifting academic norms. Future research will expand on this initial analysis, exploring disciplinary differences and their implications for academic integrity in the digital age.

Methodology

Initially, the analysis was planned to include the two largest and oldest scientometric databases: Web of Science Core Collection (WoS CC) and Scopus. However, serious difficulties were encountered while downloading and cleaning the data from WoS CC. These challenges resulted in outputs of questionable validity, which prompted us to restrict this preliminary study to the Scopus database. The decision to focus on Scopus was based on its clearer and more interpretable methodological framework. The choice to defer the integration of WoS CC data to a future study was made to ensure the reliability of the findings. A subsequent investigation will focus on assessing the capacity and suitability of WoS CC for measuring citations to personal communications, an issue that remains open and warrants further exploration.

In Scopus, the search string REF("pers* comm*") was used in the Advanced Search.This search yielded 232,429 documents that cited one of these terms in their references (as of 1.11.2024). As two indexed and cited journals, IEEE Personal Communications[1] and Wireless Personal Communications[2], were found under the results of this search in Scopus, they were excluded from this analysis. Thus, the refined search string to identify citing documents was: `((REF("person* commun*")) AND NOT (REF("wire* person* commun*")) AND NOT (REF("IEEE* person* commun*"))`. This search returned 95,580 citing documents. Due to download limits (max. 20,000 documents), the data was downloaded in batches organized by publication year.

To retrieve cited documents, the following steps were taken: Within the above described search, the "Secondary documents"[3] tab was activated to identify documents referenced in Scopus articles but not directly available in the Scopus database. 76,538 documents were obtained (as of 1.11.2024). The search was then refined to include only documents where the source contained any form of "person* commun*" (i.e. again, documents citing the two journals IEEE Personal Communications and Wireless Communications were excluded from further analysis). The remaining 65,544 documents (approximately 85% of the initial amount) were then analysed. Cited personal communications were clustered according to their citation form. Most common citation forms were identified and depicted.

To clarify the terminology used in this study, we distinguish between **cited personal communication** and **citing personal communication** as follows:

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[1] IEEE Personal Communications ceased publication in 2001. The current retitled publication is **IEEE Wireless Communications**.

[2] **Wireless Personal Communications** is an archival, peer reviewed, scientific and technical journal addressing mobile communications and computing. It investigates theoretical, engineering, and experimental aspects of radio communications, voice, data, images, and multimedia. The journal features five principal types of papers: full technical papers, short papers, technical aspects of policy and standardization, letters offering new research thoughts and experimental ideas, and invited papers on important and emerging topics authored by renowned experts.

[3] According to Scopus, a **secondary document** is "a document that has been extracted from a Scopus document reference list but is not available directly in the Scopus database since it is not indexed by Scopus." For these secondary documents, limited functionality is available.

- **Cited personal communication** refers to any reference explicitly labeled as "personal communication" in a Scopus-indexed journal. Since personal communications cannot constitute a source document (i.e., they are not formally published works), they only appear under the category of *secondary documents* within the Scopus database.
- **Citing personal communication** refers to any article indexed in Scopus that, in its year of publication, has cited at least one "personal communication." It is important to note that personal communications can only be cited in the same year or in previous years relative to the publication date of the citing article, as they lack a formal publication timeline.

The evolution of the number of cited personal communications and the number of citing articles was then retrieved. To assess whether the evolution of citations of personal communications is solely influenced by the increasing number of publications indexed in this source, the annual number of indexed publications in Scopus was retrieved using the Advanced Search feature and the command 'PY after 1970.' By dividing the annual number of cited and citing personal communications by the number of publications indexed each year, we calculated the "Normalized Citation Rate (NCR)" o "Normalized Citation Frequency (NCF)" of personal communications in the data source Scopus. To facilitate interpretation, this value was multiplied by 10,000. The resulting metric represents the normalized citation rate per 10,000 publications indexed annually for cited PCs or documents citing PCs.
To address Research Question 3, which investigates how personal communications are cited in academic literature and the contexts in which they appear, a series of systematic searches were conducted in the Scopus database. These searches aimed to identify instances where the phrase "personal communication" (or its variations) was used in conjunction with specific terms that represent various forms of communication.
The queries employed Boolean logic with proximity operators to ensure that relevant terms appeared within close context (7 words apart) of the key phrase. The following search strings were used:

- REF("person* commun*" W/7 "oral*") – to identify citations referencing oral communications.
- REF("person* commun*" W/7 email*) – for emails.
- REF("person* commun*" W/7 letter*) – for written letters.
- REF("person* commun*" W/7 interview*) – for interviews.
- REF("person* commun*" W/7 meeting*) – for meetings.
- REF("person* commun*" W/7 conference*) – for conferences.
- REF("person* commun*" W/7 memo*) – for memos.
- REF("person* commun*" W/7 blog*) – for blogs.
- REF("person* commun*" W/7 openai*) – for OpenAI tools.
- REF("person* commun*" W/7 chatgpt*) – for ChatGPT references.
- REF("person* commun*" W/7 review*) – for reviews.

These searches performed on November 20224 allowed us to explore how personal communications are contextualized in academic citations, particularly in relation to

oral and written forms of communication, emerging AI tools like ChatGPT, and specific collaborative settings such as meetings or conferences. The findings from these targeted searches were analyzed to determine the prevalence of personal communications in different contexts and their alignment with citation practices in the scholarly literature.

Finally, citing articles were grouped into subject areas, and we ranked subject areas according to the ratio of citing personal communications within each field and thus identified disciplines where personal communications seem to play a prominent role. These results were compared with the percentages each area represented in the database during the analyzed period (after 1970) to determine whether the proportions merely reflect the coverage of each discipline within the database.

Results

Table 1 below lists the most common citation forms for "personal communications" in Scopus. The most frequently used form is "Personal communication," with over 29,000 citations, followed by "Personal Communications" with 1,167 citations. Variations in formatting, such as capitalization, punctuation, and inclusion of phrases like "to the author" or "via email," create a wide range of forms. This diversity in citation styles reflects inconsistency in how personal communications are referenced across different documents in Scopus.

Table 1. Most common citation forms for "Personal Communications" in Scopus.

Cited form in Scopus	# citations	% of 65544
Personal communication	29261	44.64%
Personal Communications	1167	1.78%
Personal communication.	813	1.24%
Personal communication with the author	386	0.59%
Personal communication with author	317	0.48%
Personal Commun	154	0.23%
Personnal Communication	134	0.20%
Personal Communication to the Author	104	0.16%
Personnel communication	95	0.14%
Personal communication to author	77	0.12%
Personal Communication With the Authors	74	0.11%
Personal Communication Via Email	59	0.09%
Personal Commun.	59	0.09%
Personal Communication,	53	0.08%
Personal communications.	52	0.08%
Personal communication with authors	41	0.06%
Personal Communication Via E-mail	35	0.05%
Personal communication by email	35	0.05%
(Personal Communication)	33	0.05%
Personal Communication to the Authors	32	0.05%

The results of the evolution of the cited and citing personal communications in Scopus are shown in **Figure 1**. The number of "personal communications" citations in Scopus reveals a notable pattern: Those citations began to gain momentum in the early 1970s, corresponding with a period when Scopus's coverage became more comprehensive. This growing trend in absolute numbers of "personal communications" citations continued, reaching a peak around **2012** with approximately 2,215 cited references and 5,000 citing documents. Post-2018, a decline in citations is apparent, suggesting a reduced emphasis on "personal communications" as a source in scientific literature.

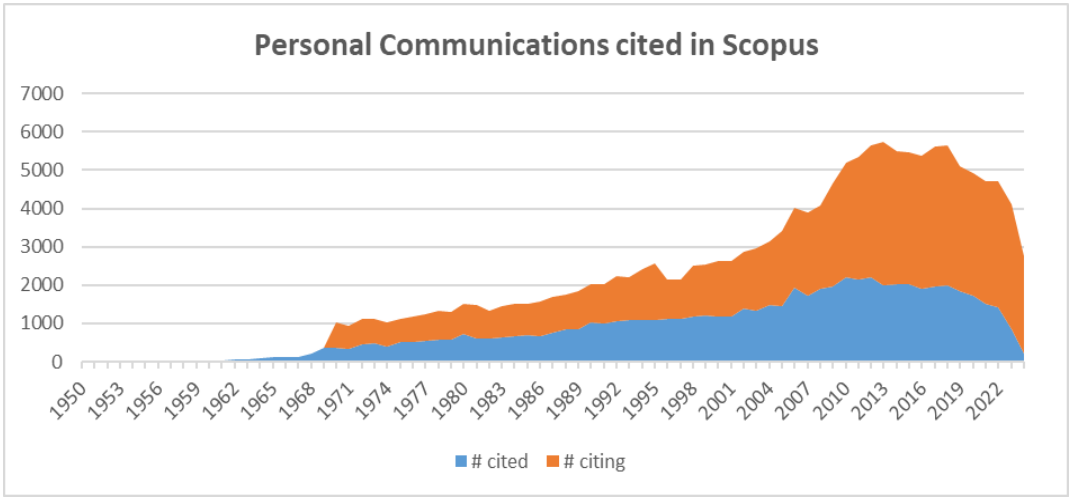

Figure 1. Trends in Citations/Cited of "Personal Communications" in Scopus.

Figure 2 shows the results for the Annual Normalized Citation Rate (NCR) of Personal Communications in Scopus (*cited* in red; *citing* in blue). This normalization eliminates potential effects caused by annual variations in the number of publications indexed in the Scopus database, ensuring a more accurate comparison over time.

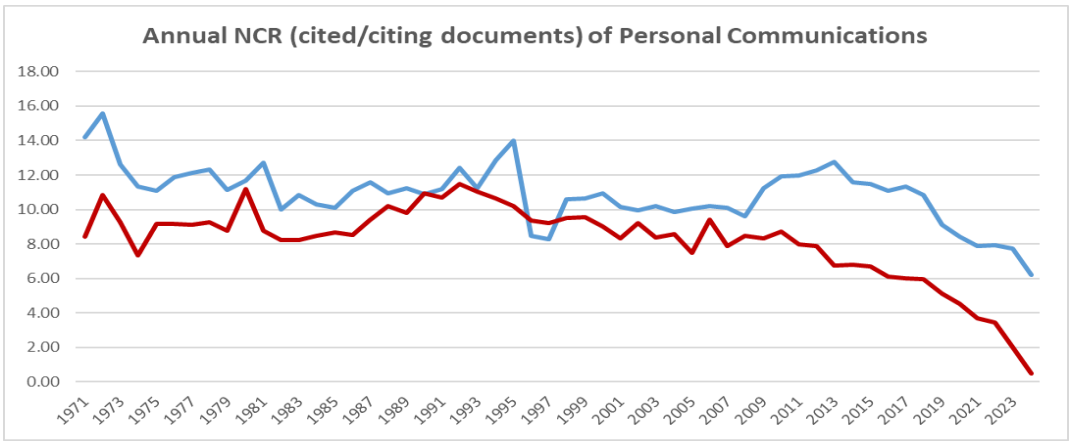

Figure 2. Annual Normalized Citation Rate (NCR) of Personal Communications in Scopus (cited in red; citing in blue).

From this chart, the following insights can be drawn:

1. Overall Decline in Citations of Personal Communications:
   - The graph shows a general decline in the annual NCR (Normalized Citation Rate) of personal communications over the decades.
   - While both the cited and citing trends started relatively high in the 1970s, they have consistently decreased, with a sharper decline after the late 1990s.
2. Sharp Drop in the Late 1990s and Early 2000s:
   - The late 1990s and early 2000s saw a significant decline in the use of personal communications as sources in citations. This period coincides with the rise of digital communication platforms, particularly the increased adoption of email and the early stages of the internet becoming widely available.
3. Impact of Social Media and Digitalization:
   - The continued decline through the 2010s aligns with the rise of social media platforms, blogging, and other online platforms that may have replaced informal personal communications as a source for scholarly interaction. Digital platforms offer more public, archivable, and citable forms of communication, potentially reducing reliance on private and informal exchanges.
4. Steepest Decline in the Past Decade (2010-2020):
   - The steep decrease in citations during this period may reflect a paradigm shift in scholarly communication. Researchers might prefer more formal and traceable sources, such as public online discussions, preprints, or data repositories, over informal personal communications.

Table 2. Results of citation of personal communications in different contexts.

Search query	# items	# secondary documents	cited by
REF("person* commun* W/7 "oral*)	39	41	26
REF("person* commun*" W/7 email*)	775	576	497
REF ("person* commun*" W/7 letter*)	356	141	118
REF ("person* commun*" W/7 interview*)	344	567	306
REF ("person* commun*" W/7 meeting*)	273	189	194
REF ("person* commun*" W/7 conference*)	9972	298	
REF("person* commun*" W/7 memo*)	319	32	44
REF ("person* commun*" W/7 blog*)	5	3	3
REF ("person* commun*" W/7 openai*)	4	1	1
REF ("person* commun*" W/7 chatgpt*)	5	4	5
REF("person* commun*" W/7 review*)	1804	304	151

These results illustrate the prevalence of personal communications in different contexts:

- The most frequent context for citing personal communications was found in "review" documents, with 1,804 items, followed by "conference" documents (9,972 items) and "email" communications (775 items). This indicates that personal communications are most often referenced in reviews and conferences, suggesting these contexts emphasize informal or non-formalized exchanges.
- AI-Related Citations:
  Emerging technologies like ChatGPT and OpenAI tools showed minimal representation, with only 4 items each. This suggests that, at present, AI tools have a limited role in personal communications as cited in academic work, which may change as these technologies become more integrated into scholarly activities.
- Secondary Documents and Citations:
  Secondary documents and citation counts were relatively consistent with the prevalence of the primary items. For instance, "email" communications were referenced in 576 secondary documents and cited 497 times, while "letter" communications were associated with 141 secondary documents and cited 118 times. The high citation count for email communications highlights its growing importance as a medium of exchange in academia.
- Interpersonal Communication Forms:
  Other forms of interpersonal communication, such as meetings (273 items), interviews (344 items), and memos (319 items), demonstrated moderate representation. However, their relatively low secondary document and citation counts suggest that these contexts are not as widely disseminated or influential as conference or review materials.
- Comparison Across Contexts:
  Interestingly, oral communication was cited 39 times, with relatively low representation in secondary documents (41) and citations (26). This may indicate that oral communications are harder to formalize or verify in academic publications compared to written or electronic exchanges. Similarly, blogs (9 items) showed limited relevance in academic references.

Finally, **Table 2** presents an analysis of the subject areas in which “personal communications” are most frequently cited. This analysis was conducted on the 95,580 citing documents between 1971 and 2024, revealing the disciplines where personal communications play a prominent role in reference practices.

Table 2. Top Scopus Subject Areas Citing Personal Communications (1971.2024).

SUBJECT AREA	# Publications citing Personal Communications	% citing publications	Subject Area Percentage in Scopus	Normalized % publications citing
Engineering	23330	14.27%	11.96%	1.19
Computer Science	18955	11.60%	6.24%	**1.86**
Social Sciences	17925	10.97%	5.34%	**2.05**
Medicine	15835	9.69%	17.31%	0.56
Mathematics	9351	5.72%	3.84%	1.49
Environmental Science	9067	5.55%	3.30%	**1.68**
Chemistry	7609	4.66%	4.89%	0.95
Arts and Humanities	6715	4.11%	2.75%	1.49
Physics and Astronomy	6564	4.02%	6.88%	0.58
Agricultural and Biological Sciences	5976	3.66%	4.00%	0.91
Materials Science	5167	3.16%	5.80%	0.55
Biochemistry, Genetics and Molecular Biology	5112	3.13%	6.80%	0.46
Earth and Planetary Sciences	4750	2.91%	2.75%	1.06
Energy	4197	2.57%	1.99%	1.29
Psychology	4052	2.48%	1.36%	**1.82**
Business, Management and Accounting	3617	2.21%	1.59%	1.39
Chemical Engineering	3116	1.91%	2.61%	0.73
Economics, Econometrics and Finance	2398	1.47%	1.06%	1.38
Others	9714	5.94%		

The table presents the distribution of publications citing personal communications across different subject areas in the Scopus database (1971–2024). The Normalized % Publications Citing column adjusts for the representation of each subject area within the database, providing a more accurate comparison.
Key findings include:

- Social Sciences (2.05), Computer Science (1.86), and Psychology (1.82) exhibit the highest normalized citation rates for personal communications. These fields rely significantly on informal and direct exchanges, possibly due to their emphasis on qualitative insights, theoretical discussions, and evolving methodologies.
- Engineering (1.19), Mathematics (1.49), and Environmental Science (1.68) also show above-average reliance on personal communications, indicating that these disciplines often engage in direct knowledge-sharing beyond formally published literature.
- In contrast, Medicine (0.56), Biochemistry, Genetics and Molecular Biology (0.46), and Materials Science (0.55) have notably low normalized citation rates. These fields generally depend more on formal, peer-reviewed sources, where reproducibility and documentation are crucial.

- Physics and Astronomy (0.58) and Chemistry (0.95) also exhibit lower-than-average reliance, likely due to the structured and empirical nature of their research.

Discussion and conclusions

Despite the fact that major style guides continue to stipulate that personal communications should be cited only in the text and not included in the reference list, our results obtained from Scopus show a significant use of personal communications as references, with notable differences in citation formats and volume. The presence of abbreviations and minor format variations highlights the lack of standardized citation practices for personal communications. These inconsistencies can distort bibliometric analyses, leading to under- or over-representation of certain citation forms.

Given this variability, we propose the adoption of a standardized citation format for personal communications: **Cited Person, Year, Personal Communication: Type (e.g., oral, letter, memorandum, interview, email, social media, etc.).**

Such a format would enhance data consistency and comparability in bibliometric studies while preserving transparency in academic referencing.

The findings of this study are a first attempt to highlight the evolving role of personal communications in scholarly research and how their citation patterns vary across disciplines. The results reveal a significant shift in the use of personal communications as citations over time, reflecting broader transformations in academic communication, technological advancements, and changing publication practices. However, the observed decline in such citations is not due to a stricter enforcement of these long-standing style guidelines—there is no evidence to suggest this—but rather to the transformative impact of technological advancements in scholarly communication.

The study results hints at a progressive decline in personal communication citations, particularly since the late 1990s, corresponding with technological advancements and digitalization in scholarly communication. The sharp drop observed in the early 2000s coincides with the widespread adoption of email, digital archives, and open-access repositories, which have provided researchers with more formalized, traceable, and archivable alternatives to personal communications. The further decline in the 2010s and 2020s aligns with the emergence of preprint servers, academic social networks, and AI-generated research tools, which enable rapid knowledge dissemination without relying on direct personal exchanges (Koutras, 2021).. These findings might indicate that as scholarly communication becomes more structured, informal references are becoming less relevant in academic citations. However, informal exchanges themselves remain central to knowledge production, even if they are less frequently acknowledged in citation records.

The subject-area analysis shows substantial variation in the reliance on personal communications across disciplines:

- Social Sciences: The high citation rates likely stem from the importance of qualitative insights, interviews, and theoretical discussions, which often rely on informal exchanges rather than strictly published sources.
- Computer Science: The strong reliance on personal communications may reflect the field's rapidly evolving nature, where many breakthroughs first circulate through direct peer discussions before formal publication.
- Medicine and Biochemistry: These fields follow highly structured research methodologies, where reproducibility and verification are critical, reducing the necessity for citing informal communications.
- Physics, Chemistry, and Engineering: These disciplines show moderate reliance on personal communications, potentially due to collaborative work environments where technical discussions and experimental insights are shared informally before publication.

These differences highlight how personal communications are perceived and utilized differently depending on the academic field.

The Changing Role of Informal Communication in Academia

Although citations of personal communications have declined, informal academic exchanges remain central to research collaboration. The transition toward digital platforms, AI-driven tools, and collaborative research networks is reshaping how scholars share knowledge.

Interestingly, the low representation of AI-related citations (e.g., ChatGPT and OpenAI, with only four citations each) suggests that AI-generated insights are not yet widely recognized as a valid form of personal communication in academia. However, this trend may be shifting. As highlighted in recent bibliometric analyses, AI tools are increasingly being cited as sources or acknowledged in research papers, reflecting their growing role in scientific discourse, despite the lack of formal authorship recognition (Gorraiz, 2025).

These preliminary results answer the question "Should AI-generated insights be classified under the same category as personal communications?" with a clear no. AI-generated insights are not cited under the category of personal communication but rather follow their own distinct citation dynamics.

The findings of Gorraiz (2025) indicate that while AI contributions are still in an early adoption phase, their presence is expanding, particularly through acknowledgments and citations as computational tools. Ethical concerns and academic publishing guidelines (e.g., COPE) currently prevent AI from being credited as an author, reinforcing the notion that AI is primarily viewed as an assistive tool rather than an intellectual contributor. However, as AI tools become more embedded in scholarly workflows, their influence on informal academic exchanges and citation practices is expected to grow substantially, potentially reshaping how researchers engage with personal communications in the future.

The continued prevalence of emails, letters, and direct correspondences in reviews and conference proceedings suggests that despite the decline in citation frequency, personal communications still play a significant role in academic knowledge-sharing. Review articles and conference papers frequently cite unpublished

conversations, expert opinions, and preliminary results, reinforcing the idea that informal exchanges are still valuable, even if they are less frequently acknowledged in citation records.

Addressing Citation Challenges in Peer Review and AI-Generated Content

One possible solution to citation inconsistencies is to categorize peer review comments under personal communications, acknowledging the reviewer as the source. This approach would align with ethical academic standards and ensure proper recognition of intellectual contributions. The absence of clear citation guidelines for peer review content has thus emerged as a key motivation for this study, highlighting the urgent need for publishers and institutions to develop standardized recommendations that promote transparency and respect within the peer review process (Tennant et al., 2019).

Finally, this study suggests that AI-generated insights are not yet widely cited as personal communications but may soon become more prominent. Future research should further explore the evolving role of AI-generated knowledge in academic citations and investigate whether AI-driven tools will transform informal scholarly exchanges.

Final Thoughts and Future Considerations

By mapping the historical trajectory of personal communications as citations, this study provides a foundation for understanding their current role and the challenges posed by emerging technologies. As digital communication continues to evolve, the boundaries between formal publications and informal scholarly exchanges will likely continue to shift, shaping the future of academic discourse.

This study represents the first in-depth attempt to analyze the evolution of personal communications in scientific discourse and is part of an ongoing research project at the University of Vienna. As such, the findings should be viewed as preliminary insights, with further analyses planned to assess the suitability of data sources and provide a deeper contextual interpretation of the results. In parallel, we are also investigating whether personal communications are mentioned in acknowledgments, and these results will be presented at the upcoming conference.

These findings also highlight the importance of rigorous data handling in bibliometric research, particularly when analyzing citation forms with high variability. Researchers utilizing bibliometric databases should be aware of inconsistencies and potential indexing errors to ensure accurate representation and interpretation of citation trends in personal communications.

Finally, this study underscores how disciplinary differences, technological advancements, and the open-access movement influence how personal communications are incorporated into academic research. As digital communication continues to evolve, the boundaries between formal publications and informal scholarly exchanges will likely continue to shift, shaping the future of academic discourse.

Limitations

Despite these efforts to clean and refine the data, limitations inherent to the databases and their search functionalities may still have influenced the findings.

Another limitation of this study, which is common in scientometric and sociological research, is the lack of a strong cause-and-effect relationship. One of the primary reasons for this is the inherent inability to eliminate all other potential causal factors from the analysis. Consequently, particularly with regard to Research Question 3, our findings can only point to **signs** that require further observation and investigation to be fully confirmed. For instance, the idea that personal communications have already been replaced by the internet, which has established its own specific channels of communication—from emails to blogs, among others—and might be further overshadowed by the rise of AI tools, can only be suggested as a potential trend. Similarly, the notion that the esteemed and trusted colleague will not eventually be replaced by an intelligent tool—one built on the knowledge and experience of countless professionals—appears to be more a matter of time than an impossibility. However, these observations remain speculative and require longitudinal studies to validate such hypotheses.

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