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Influencing Factors and Application Analysis of Altmetrics Coverage Rate (Postprint)

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Abstract

[Objective/Significance] This study investigates the factors influencing altmetrics coverage, aiming to lay a foundation for the rational application of altmetrics in academic evaluation. [Methods/Process] Based on Web of Science, Altmetric.com, and Mendeley, and taking all journal articles published between 1996 and 2015 across five disciplines as the analytical sample, this paper examines the impact of five factors—discipline field, publication year, source journal, country, and language—on altmetrics coverage. [Results/Conclusions] Coverage rates vary across different altmetrics indicators, with Mendeley exhibiting the highest coverage, followed by Twitter, while most other indicators show very low coverage. When applying altmetrics to journal evaluation, it is necessary to properly identify and exclude high coverage phenomena resulting from journal promotion strategies. The aforementioned five factors all contribute to differences in altmetrics coverage of journal articles. Therefore, when applying altmetrics, it is essential to consider the attribute characteristics of the objects being evaluated, and to consider standardizing altmetrics across these influencing factors when necessary.

Full Text

Preamble

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Analysis of Influencing Factors and Application of Altmetrics Coverage

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Abstract

[Purpose/Significance] This study explores the factors influencing altmetrics coverage, laying the foundation for the rational use of altmetrics in academic evaluation. **[Method/Process]** Based on Web of Science, Altmetric.com, and Mendeley, this study examines all journal articles published between 1996–2015 across five disciplines to investigate how five factors—disciplinary field, publication year, source journal, country, and language—affect altmetrics coverage. **[Results/Conclusion]** Different altmetrics indicators exhibit varying coverage rates: Mendeley has the highest coverage, followed by Twitter, while most indicators have very low coverage. When applying altmetrics to journal evaluation, it is necessary to identify and exclude artificially high coverage resulting from journal promotion strategies. All five factors contribute to differences in altmetrics coverage across journal articles. Therefore, when applying altmetrics, the characteristics of the evaluated objects must be considered, and standardization across these influencing factors may be necessary.

Classification Number: G250

Keywords: altmetrics, coverage, influencing factors

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Introduction

J. Priem, a doctoral student in Library and Information Science in the United States, first proposed altmetrics (alternative metrics) in 2010. Since then, altmetrics has continuously evolved, attempting to measure the influence of scholarly outputs across various online platforms [1-2], such as online reference management tools, social media, and academic blogs. While altmetrics offers advantages over traditional citation-based evaluation in terms of data openness, diversity, and the breadth and speed of measurement, its data quality and measurement reliability and stability remain debatable [3]. Altmetrics is a complex set of indicators encompassing various types, including mentions, downloads, shares, and read counts. This study analyzes altmetrics coverage of journal articles across different disciplines, publication years, source journals, countries, and languages, examining whether and to what extent coverage differences exist, thereby providing recommendations for the application of altmetrics in academic evaluation and its future development.

Related Research

Scholars have noted disciplinary differences in altmetrics performance and its bias toward newer literature. Consequently, empirical studies have accounted for factors such as discipline, document age, and country, offering valuable insights for understanding and rationally using altmetrics. Some researchers have limited their scope to specific disciplines. For example, B. Hammarfeldt [4] analyzed Swedish humanities journal articles and books published in 2012,

finding that Mendeley readership had the highest coverage, Twitter mentions ranked second, while other altmetrics indicators showed very low coverage. S. Haustein et al. [5] found that in the field of bibliometrics, Mendeley (as an online academic exchange platform) had significantly higher coverage (82%) than CiteULike (28%). Most studies have found that altmetrics coverage varies by discipline. For instance, S. Barthel et al. [6] showed that computer science was the only field with CiteULike readership, while social sciences received more attention on Twitter. Other studies have found higher altmetrics coverage for medical research. Z. Zahedi et al. [7] randomly sampled 20,000 articles with DOIs and found that medical and life sciences outputs appeared most frequently on Mendeley, Twitter, and Wikipedia. M. Erdt et al. [8] investigated Singapore-based articles using Scopus and Altmetric.com, finding that altmetrics indicators had the highest coverage in medicine, biology, chemistry, and physics. R. Costas et al. [9] confirmed that scholarly outputs are uncommon and sparse on social media, with coverage varying by discipline—social sciences/humanities and medical/life sciences had higher coverage at approximately 23%.

Beyond disciplinary differences, online platforms may show varying attention to publications of different ages. Research indicates that most altmetrics indicators favor newer literature [9], as altmetrics responds rapidly to research hotspots with faster data updates, potentially reflecting the impact of newly published articles more quickly. However, differences exist depending on platform characteristics. Online academic exchange platforms and academic sharing sites require accumulation time, while social media mentions can accumulate quickly, showing a stronger bias toward recent publications. For example, M. Thelwall and K. Kousha [10] found that ResearchGate users uploaded approximately three times more new documents than older ones. Guo Fei et al. [11] discovered that hot papers typically reach their Twitter mention peak within 10–30 days.

Studies have also found that due to uneven global development of online academic exchange platforms and social media, developed countries hold numerous advantages, and altmetrics favors research from these nations [12]. J. P. Alperin [13] examined altmetrics coverage for Latin American publications, finding very low coverage across most indicators—only Mendeley, Twitter, and Facebook exceeded 2%.

While these studies have explored altmetrics coverage from various perspectives, most have examined only single or few influencing factors. This study comprehensively investigates five potential factors—disciplinary field, publication year, journal, country, and language—using a dataset covering five representative sub-disciplines from Web of Science’s five major disciplinary categories. Unlike previous descriptive statistical analyses, this study delves deeper into the causes of coverage differences. More importantly, it proposes practical recommendations for altmetrics application, providing guidance for its rational use in academic evaluation and future development.

Research Design

3.1 Research Questions

Based on literature review and preliminary research, this study selects five factors—disciplinary field, publication year, journal, country, and language—to examine whether and how journal articles' online attention varies across these dimensions, addressing the following questions:

1. Which disciplines' literature is more likely to receive altmetrics attention?
2. Is the impact of newer literature more easily and rapidly reflected in altmetrics than older literature? Which altmetrics indicators favor newer publications?
3. Does altmetrics coverage differ across journals? Do journals with higher altmetrics coverage also have higher impact factors? Does altmetrics exhibit a phenomenon analogous to self-citation in citation analysis?
4. Does altmetrics coverage vary by country? Do developed countries' research outputs demonstrate higher altmetrics coverage?
5. Does altmetrics attention differ across languages? Does English literature hold absolute dominance?

Of course, numerous other factors influence altmetrics coverage beyond these five, including open access status, publication type, interdisciplinary degree, data quality, and user demographics—representing limitations of this study.

3.2 Dataset

Based on Web of Science (WoS), Altmetric.com, and Mendeley, this study uses all journal articles published 2005–2016 in five sub-disciplines from WoS's five major categories: nursing, library and information science, physical geography, philosophy, and linguistics. First, bibliographic information (discipline, publication year, journal, corresponding author country, language, DOI) was retrieved from WoS on July 12, 2017. Then, 17 specific altmetrics indicator values (see Table 1) and Altmetric Attention Score (AAS) values were obtained from Altmetric.com and Mendeley between July 16–18, 2017. Articles were deemed altmetrics-covered if they had non-zero AAS values.

From 306,419 articles downloaded from WoS, 232,925 (76%) had DOIs, constituting the total dataset (N). Among these, 66,964 (29% of N) had non-zero AAS values, forming the altmetrics dataset (A), which serves as the primary analysis object.

3.3 Research Methods

This study primarily uses AAS coverage to reflect altmetrics attention to journal articles, defined as the proportion of papers with AAS values among all analyzed documents. AAS coverage is calculated across the five influencing factors to examine coverage differences. For publication year analysis, beyond

AAS coverage, seven indicators with $>1\%$ coverage from Table 1 were selected for detailed investigation.

Analysis of AAS Coverage Influencing Factors

4.1 Disciplinary Field

To explore platform users' attention to literature across disciplines, Figure 1 [Figure 1: see original paper] presents AAS coverage by discipline. All disciplines show relatively low AAS coverage, ranging between 20%–40%. Low coverage reflects both low exposure of scholarly outputs on online platforms and low usage rates of social networks among researchers [5, 16]. Nursing exhibits the highest AAS coverage at approximately 40%, consistent with previous findings of higher medical literature coverage [8-9]. Library and information science, despite having the smallest literature volume, ranks second at 33% coverage. The remaining three disciplines show similar rankings for both literature volume and AAS coverage.

Disciplinary differences in altmetrics coverage also reflect variations in active users' disciplinary backgrounds on online platforms. For example, J. L. Ortega [17] analyzed user demographics on academic social networking sites in 2015, finding humanities and social science scholars predominated on Academia.edu, biologists were most prevalent on ResearchGate, and computer/information scientists primarily used Google Scholar Citations. In terms of communication behavior, scholars in humanities, social sciences, and natural resources interacted frequently, while biologists were more passive. K. Holmberg and M. Thelwall [18] similarly found clear disciplinary differences among Twitter users across five fields (astronomy, biochemistry, digital humanities, economics, history), with varying usage behaviors and motivations.

This implies that when applying altmetrics to specific disciplines, the primary active platforms and appropriate indicators for that discipline should be considered—not all altmetrics indicators should be included indiscriminately. Given varying attention levels across disciplines, standardization may be necessary when applying altmetrics to academic evaluation, particularly for disciplines with substantially different AAS coverage.

4.2 Publication Year

Figure 2 [Figure 2: see original paper] shows AAS coverage by publication year. Total paper volume, AAS-covered quantity, and AAS coverage all show stable increasing trends, especially after 2011, with AAS coverage for 2015 publications reaching 44%. This overall upward curve indicates that altmetrics generally focuses on newer publications, with lower coverage for older papers—consistent with prior research [9, 11].

However, analyzing seven indicators with $>1\%$ coverage reveals three distinct

relationships between indicator coverage and publication year (see Figure 3 [Figure 3: see original paper]):

1. **No clear relationship:** Mendeley readership shows no obvious correlation with publication year (Figure 3(a)), consistent with J. Priem et al. [19]. M. Thelwall and P. Sud [20] found that older documents have gained Mendeley readership in recent years, suggesting Mendeley attention is an ongoing accumulation process. Figure 3(a) shows 2012–2016 publications have not yet reached their decay phase on Mendeley and require more time to stabilize.
2. **Preference for newer literature:** Most indicators, exemplified by Twitter mentions, favor newer publications, including Facebook mentions, academic blogs, and mainstream media (Figure 3(b)). These platforms emphasize “newness” and “speed,” making their bias toward recent literature understandable. S. Haustein et al. [21] found Twitter users prefer mentioning newly published rather than older documents. Twitter and Facebook coverage increased significantly after 2011, partly due to rapid social media development post-2010 and partly because earlier tweet data is difficult to collect.
3. **Preference for older literature:** Few indicators, such as policy documents and Wikipedia mentions, favor older literature (Figure 3(c) shows policies as an example). Policy documents prefer older literature because: (1) policy formulation requires long-term research foundations with rigorous citations; (2) new policies inherit and deepen rather than completely negate old ones; and (3) policy citations are less strictly regulated than in scientific papers, so not all referenced works appear in policy documents. Wikipedia, though a public platform, emphasizes academic circles, resulting in low coverage that tends toward authoritative older literature tested by time. Figure 3(c) also shows very low coverage in policy documents, similar to findings by R. Haunschild and L. Bornmann [22], who concluded that policy mentions are insufficient for measuring impact in academic evaluation.

4.3 Journal

In current academic evaluation, journal impact factor serves as an important indicator of individual paper quality. Users often select literature based on journal reputation. In the online environment, we examine whether altmetrics attention is influenced by source journals and whether these influences stem from journal quality or other behaviors.

First, Table 2 shows that over 80% of journals in each discipline receive altmetrics attention, with three disciplines exceeding 90%. Second, detailed analysis of each journal’s AAS coverage (excluding journals with 0% coverage) reveals an overall mean coverage of 26.65% per journal, with positive skewness indicating most journals have low coverage and a right-tailed distribution (Figure 4 [Fig-

ure 4: see original paper]). Nursing journals show the highest mean coverage at 41.54%, consistent with M. Erdt et al. [8] and R. Costas et al. [9]. Linguistics shows the lowest coverage at 20.42%, which aligns with subsequent findings on language distribution (see Section 4.5).

Some journals exhibit AAS coverage exceeding 90%. For example, *International Journal of Older People Nursing* achieves 100% coverage, with all 49 nursing articles covered. However, investigation reveals that some high-coverage journals are not top-tier in their fields, suggesting promotion strategies drive their high coverage—a phenomenon J. P. Alperin [13] also noted. Journal promotion includes: (1) journal self-promotion, (2) promotion by parent institutions, (3) promotion by academic organizations, and (4) promotion by individual users with specific interests. These activities increase altmetrics values.

To verify this, we examined journals with >80% AAS coverage on Twitter (excluding one journal with too few articles). Results in Table 3 show:

1. **Journal self-promotion:** Journals with >90% coverage almost all have Twitter accounts and regularly/irregularly promote their newly published articles.
2. **Parent institution promotion:** Some publishers have Twitter accounts promoting articles across their journals. For example, SAGE Publishing operates multiple official accounts: @SAGE nursing aggregates and promotes nursing-related articles, while @SAGE cardiology focuses on cardiology research, resulting in 85% coverage for *Journal of Cardiovascular Nursing*.
3. **Academic organization promotion:** Organizations promote quality or cutting-edge literature. *Australasian Emergency Nursing Journal* (86% coverage) frequently appears in tweets from @CENAorg (College of Emergency Nursing Australasia) and @AusEmergCare.
4. **Individual user promotion:** Individual users dedicated to specific fields increase coverage. For example, Twitter user @ThihaSwe_{dr} specializes in psychiatry research, pushing coverage of *Journal of the American Psychiatric Nurses Association* to 92%.

These phenomena resemble self-citation in traditional citation analysis, which distorts evaluation fairness. Therefore, altmetrics-based journal evaluation should carefully identify and exclude coverage inflated by promotion strategies. Moreover, while many studies confirm high altmetrics coverage in medicine, this study reveals that nursing journals' high coverage largely stems from systematic promotion, warranting deeper investigation into underlying causes.

Finally, journals with low altmetrics coverage generally have low impact factors, mostly in Q4 quartiles. This suggests that, excluding promotional effects, altmetrics—like citation metrics—pays little attention to low-impact journals. However, high coverage requires careful analysis: it may reflect genuine high impact or simply effective promotion strategies.

4.4 Country

Using corresponding authors' countries to represent publication countries (excluding ~2% missing data), we found N contains articles from 174 countries, while A contains articles from 145 countries. Analysis focused on 61 countries with >100 articles in A.

Altmetrics shows greater attention to Australia, Europe, and North America, while most African countries receive little coverage. Among these 61 countries, Russia has the lowest AAS coverage at 8.25% (1,430 articles). Table 4 lists the top 5 countries by AAS coverage quantity and rate. The US leads in both total DOI-bearing articles and AAS-covered articles (25,285). The UK and China follow, though China's 3,471 covered articles represent only 14% of the US total and 54% of the UK's. Australia has the highest coverage rate at 38.3%, while China does not rank in the top five.

Reasons include: (1) altmetrics relies heavily on DOIs, which many non-developed countries' publications lack or are non-English [13]; (2) academic policy reforms in developed countries have promoted altmetrics adoption. For example, the UK's 2014 Research Excellence Framework incorporated five altmetrics indicators, Italy's AIHD project [24] developed complementary evaluation models for humanities, and the US National Science Foundation considered integrating altmetrics into evaluation. These initiatives have boosted altmetrics usage in developed countries, creating inherent advantages. Therefore, country differences must be considered in altmetrics-based evaluation, with standardization necessary for countries with vastly different coverage rates. For countries with extremely low coverage, altmetrics-based evaluation may not yet be applicable.

4.5 Language

English remains academia's lingua franca. The total dataset N involves 26 languages, with English accounting for 95.857% (Figure 5 [Figure 5: see original paper]). Dataset A involves 11 languages, with English comprising 98.84%, indicating altmetrics further amplifies the English bias—related to users' native languages on online platforms.

Table 5 shows AAS coverage by language. While English dominates in coverage quantity, altmetrics also shows relatively high coverage for Spanish and Portuguese literature. Chinese literature receives little attention from Altmetric.com indicators.

Analyzing the proportion of English and Spanish articles across WoS downloads, DOI-bearing articles, and altmetrics-covered articles (Figure 6 [Figure 6: see original paper]) reveals altmetrics' increasing English bias: from 88.1% in WoS to 95.9% in the DOI dataset, and 98.8% among altmetrics-covered articles. This fails to reduce non-English language bias, consistent with A. Mas-Bleda and M. Thelwall [25].

These language coverage differences indicate that altmetrics applications in academic evaluation must account for language variations, with standardization necessary when coverage differences are substantial.

Conclusions and Outlook

Based on coverage analysis, this study finds: (1) Different altmetrics indicators show varying coverage of journal articles, with Mendeley highest and Twitter second, while most indicators have very low coverage—raising questions about their suitability for academic evaluation. (2) Altmetrics coverage differs significantly across disciplines, publication years, journals, countries, and languages. Therefore, these differences must be considered when evaluating journal articles; one-size-fits-all approaches are inappropriate, and standardization across these factors may be necessary. Researchers have begun exploring standardization for specific indicators like Twitter and Mendeley [26-28]. (3) Widespread journal promotion on online platforms resembles self-citation in traditional evaluation. For instance, nearly all high-coverage nursing journals in this study engage in promotion. While previous studies confirmed medicine's high altmetrics coverage, they did not examine underlying causes. Given promotion's prevalence, altmetrics-based journal evaluation should identify and exclude inflated coverage. This also shows altmetrics does not always select high-quality journals—high coverage may reflect either high impact factors or effective promotion.

This study examines only five factors from a coverage perspective, proposing relevant recommendations. Many issues remain unexplored, including altmetrics data quality, missing persistent identifiers, and complex user motivations—critical challenges for future research and altmetrics development. Data quality issues (standardization, completeness, consistency, timeliness) affect practical applications. Regarding missing identifiers, altmetrics' widespread application depends on APIs and scholarly identifiers (DOIs, PMIDs, ORCID) [29]. As for user motivations, altmetrics numbers are not pure data; like citations, each metric change implies behavioral motivations and user attitudes toward scholarly outputs, which must be examined when applying altmetrics. Given these considerations, whether altmetrics can be applied to academic evaluation, in what aspects, and how to apply it scientifically all require deeper investigation.

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Author Contributions:

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