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Altmetric.com or PlumX: Does it matter?

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Abstract: Altmetric.com and PlumX are two prominent tools for collecting alternative metrics data. This study has two main objectives: first, to evaluate how the choice between Altmetric.com and PlumX affects the results of alternative metrics analysis, and second, to investigate the social impact of 'hot papers' through the alternative metrics data provided by these platforms. We employed a descriptive and exploratory approach, gathering common alternative metrics from 4236 hot papers using both Altmetric.com and PlumX. The data collected included various alternative metrics such as policy mentions, Mendeley readers, Wikipedia mentions, blog mentions, Facebook mentions, and news mentions, in addition to citation counts from Scopus. We conducted descriptive statistics and inferential analyses to examine the relationships between citations and alternative metrics, as well as to compare the data obtained from both platforms. Our findings indicate that PlumX has broader coverage of hot papers compared to Altmetric.com. While the mean and individual values of alternative metrics differ between the two platforms, the median and geometric mean are similar. Both Altmetric.com and PlumX demonstrate that publications with higher citation counts tend to receive more online attention. Notably, all alternative metrics for *Immunology* and *Chemistry* showed statistically significant differences between the two platforms, whereas in *Mathematics*, alternative metrics (with the exception of Mendeley readers) did not exhibit significant differences. The findings suggest that researchers should be aware of potential variations in data captured by different alternative metrics platforms. Additionally, interpreting alternative metrics data requires caution, considering the research fields and the specific platform used.

Keywords: Societal Impact, PlumX, Research Evaluation, Altmetric.com, Altmetrics

INTRODUCTION

The source of data has a significant impact on the reliability of studies, including bibliometrics and alternative metrics. Therefore, comparing various data sources for bibliometrics (Visser et al., 2021) and alternative metrics (Ortega, 2018a, 2018b) is an important issue for researchers in the science or research evaluation domains to consider. In the realm of alternative metrics, there are different subscription-based (such as Altmetric.com, and PlumX) and free (such as Logotto, PLOS ALM, and Impactstory) data sources. García-Villar (2021) compared some of these alternative metrics data sources, considering different aspects, such as target group, data source, type of actions, accessibility, coverage, and business model; with the results suggesting that Altmetric.com covers more data sources than other alternative metrics data providers. Wouters et al. (2019) argued that many alternative metrics data providers have a similar philosophy in reflecting the social impact of scholarly papers, but they track different sources with different methodologies. Alternative metrics data providers also report different indicators and have different coverage, accessibility, and update intervals.

Altmetric.com and PlumX are the two subscription-based platforms that have been used in academic research more than other platforms in recent years (Ortega, 2020). Digital Science launched Altmetric.com in 2012. As stated on its website, public policy documents, mainstream media, online reference managers, post-publication peer review platforms, Wikipedia, patents, Open Syllabus Project, blogs, Dimension's citations, research highlights, social media, multimedia, and other online platforms are the major data sources in Altmetric.com. Altmetric.com records attention[1] for each publication using nine types of identifier (such as DOI or PubMedID). Altmetric.com considers different weights for various data sources and automatically calculates an altmetric attention score (AAS) for every scholarly publication (www.altmetric.com). PlumX, which is now maintained by Elsevier, was founded in 2012. It provides five different metrics for every scholarly publication, including (www.plumanalytics.com):

- Citations: The source of citations in PlumX is Scopus, clinical, and policy citations.
- Usage: The number of different types of use, such as clicks, downloads, and library holdings in the different databases, such as Ebsco, Github, and WorldCat.
- Captures: This metric is counted based on the number of bookmarks, code forks, favourites, readers, and watchers in a number of different sources, such as Delicious, YouTube, Slideshare, and Mendeley.
- Mentions: This metric is related to a scholarly publication's mentions in blog posts, comments, reviews, news media, and Wikipedia references.
- Social media: PlumX records the count of shares, likes, comments, and so forth of a scholarly publication on some social networks, such as Facebook.

A significant number of scientometric studies focus on alternative metrics. Alternative metrics studies aim to study different aspects of the social impact of academic research. One of the challenging questions for the authors or reviewers of studies on alternative metrics are how the results would be affected by choosing different data providers. Reviewing studies on alternative metrics data source providers shows that some of the studies have focused on specific data sources, such as Altmetric.com (Fang & Costas, 2020; Fleerackers et al., 2022; Robinson-García et al., 2014; Yu et al., 2022) or PlumX (Ortega, 2018a, 2018b). Comparisons of Altmetric.com and PlumX have also been undertaken in some studies (Karmakar et al., 2021; Ortega, 2018a, 2018b; Ortega, 2019a, 2019b; Zahedi & Costas, 2018; Gong et al., 2022). Many of these studies have analysed or compared Altmetric.com and PlumX in terms of their data quality, data sources, and mention counts. However, there is lack of research comparing the descriptive and inferential statistical analyses in alternative metrics studies that utilize different data providers. Consequently, the primary objective of this study is to determine whether the choice between Altmetric.com and PlumX significantly impacts the results of alternative metrics data analyses. To achieve this, identical analyses were conducted using data from both Altmetric.com and PlumX, and the results were compared. Additionally, this study explores the social impact of hot papers through the alternative metrics data provided by Altmetric.com and PlumX.

Key points

- PlumX offers broader coverage of hot papers compared to Altmetric.com.
- The data provided by Altmetric.com and PlumX for the same articles show a statistically significant difference.
- There is a significant relationship between citation counts and various alternative metrics based on data from both PlumX and Altmetric.com.
- The differences in data between Altmetric.com and PlumX are smaller for the field of 'Mathematics'.

LITERATURE REVIEW

For the literature review in this study, we employed a hand-picked approach to select relevant articles that provide context and insights into the use of alternative metrics data providers. We utilized a combination of academic databases, including PubMed, Scopus, Web of Science, and LISA, and conducted searches using keywords such as 'altmetrics', 'alternative metrics', 'Altmetric.com', 'PlumX', and 'social media metrics'. We also reviewed the reference lists of relevant studies to identify additional relevant studies that may not have appeared in our initial search.

The existing body of literature on alternative metrics data providers can be divided into two main categories, including studies on specific alternative metrics data providers, and comparative studies that have compared different aspects of alternative metrics data providers. In the following sections, some studies in each category are reviewed.

[1]Attention refers to the visibility and awareness that research outputs receive, encompassing metrics such as mentions in social media, news articles, and other platforms. It indicates that the research has reached an audience, highlighting its potential influence and reach.

Studies on individual alternative metrics data providers

Various aspects of alternative metrics data providers have been the subject of academic research. Robinson-García et al. (2014) studied the content of Altmetric.com in terms of its coverage and data sources. They matched the DOI numbers of more than 2.5 million Web of Science (WoS)-indexed papers using the alternative metric's API and retrieved more than 5 million records. They found that only 19% of their sample papers were covered in Altmetric.com and data from the top five sources, including Twitter, Mendeley, Facebook, CiteUlike, and blogs, are presented for 95.5% of the papers. They concluded that although Altmetric.com is a transparent, rich, and accurate alternative metrics data source, there are still limitations on its exhaustiveness and selection of social media sources. Fang and Costas (2020) investigated the data gathering velocity of the 12 data sources of Altmetric.com. In this study, DOI-created dates and alternative metrics event-posted dates were recorded and analysed for more than 2.5 million WoS-indexed publications. They found that data accumulation velocity varies across different data sources: some are very fast, such as news, Facebook, Reddit, Blogs, and Google+, while others are slow, such as Wikipedia, policy documents, and F1000 prime. They also suggested velocity levels also varied regarding document type, subject field, and research topics. Given the results, among different publication types, editorials and letters had higher velocity than articles and reviews, and physical science and engineering along with life and earth sciences had more velocity value than other subject areas.

In a similar study, Ortega (2018b) explored the life cycle of alternative metrics and bibliometric indicators presented in PlumX. In this study, alternative metric (readers, blogs, mentions, downloads, and views) and bibliometric (citations count) indicator data were extracted for a sample of 5185 publications. The results revealed that metrics related to mentions, including tweets and blog mentions, are the earliest measures that become available soon after publication and have a shorter life cycle; readers are the most prevalent indicator after mentions. The results also suggested that download and view indicators have continuous growth and the longest life cycle. According to the results, there was a significant correlation between the mentions metrics and readers and downloads, and between readers and citation counts.

The quality of the data provided by alternative metrics data has also been a challenging issue. Yu et al. (2022) aimed to discover the accuracy of news mentions data presented in Altmetric.com. They extracted more than 5.5 million news mentions for more than 1 million scholarly publications and chose 3000 records as their study sample. The results revealed that there were errors in 42.5% of the sample records; 27.1% of the errors were related to the news platform and the rest could be attributed to Altmetric.com. The top three most common error types were inaccessible related news articles (25.9%), incorrect news links presented in Altmetric.com (6.9%), and wrong news mentions (7.9%). The authors concluded that Altmetric.com data should be improved. In a similar study, Fleerackers et al. (2022) investigated the recall and precision of Altmetric.com news mention data. Using manual content analysis of the 400 news stories and logistic regression they found that for their sample news outlets, Altmetric.com data are relatively accurate, with high precision and acceptable recall rates. They concluded that researchers could use Altmetric.com news mentions data as a relatively reliable source to identify research mentions in news platforms.

Studies comparing alternative metrics data providers

Comparison of alternative metrics data providers has been the subject of some studies. Ortega (2018a) compared the reliability and accuracy of Altmetric.com, PlumX, and Crossref Event data (CED). Ortega extracted more than 67,000 research papers from PlumX, which were then were searched in Altmetric.com and CED. The results revealed that Altmetric.com has the best coverage of blogs, news, and tweets; while PlumX had better coverage of Mendeley readers, and CED had better performance in covering Wikipedia citations. Ortega concluded that there is a significant counting difference among these three data providers due to their technical errors and data extraction methods. In another study, Zahedi and Costas (2018) studied the data quality in the five main alternative metrics data providers, including Altmetric.com, CED, Lagotto, PlumX, and Mendeley. They used the DOIs of 31,437 papers published in 2018 in the journal *PloS ONE*. The results showed a significant difference among the alternative metrics data providers regarding their data and metrics. They assigned this difference to different coverage of various social media platforms, and different methods of collection, process, summarization, and update of metrics in alternative metrics providers.

Ortega (2019a) and Ortega (2019b) analysed the availability and audits of links provided by Altmetric.com, PlumX, and CED. He extracted 51,000 news and blog links from three alternative metrics providers and analysed them with a link checker. The results showed that 35.6% of news links on Altmetric.com and 28.9% of blog links in PlumX are not accessible. He argued that these worrying rates of unavailable links are due to the use of third parties to collect news and blog posts. Additionally, the results of this study showed that Altmetric.com has a better-balanced distribution of events, while PlumX and CED have more coverage of the last 2 years' events. He concluded that alternative metrics data providers need to have a specific policy to improve the audit of their data. Bar-Ilan et al. (2019) investigated data accuracy, and the count of mentions reported for 2728 papers in Mendeley, Altmetric.com, and PlumX. The results showed that the mentions count reported by Altmetric.com and PlumX are different.

Karmakar et al. (2021) compared the coverage and mentions of events on Altmetric.com and PlumX. They analysed the coverage of more than 1.5 million WoS-indexed papers in the two providers. They found that PlumX covered more alternative metrics sources and provided alternative metrics events data for a larger number of papers than Altmetric.com. However, coverage of various social media platforms was different in these two alternative metrics data providers; Altmetric.com had greater coverage of Twitter and blogs, and PlumX recorded higher mentions on Facebook and Mendeley. Gong et al. (2022) also investigated the quality of alternative metrics data in Altmetric.com and PlumX. They analysed 12,000 DOIs of WoS-indexed papers in each alternative metrics data provider. The results suggested that Altmetric.com had a better performance on covering Twitter and news mentions; while PlumX was good at covering Wikipedia citations and Mendeley data.

TABLE 1 Summary of key findings from studies on alternative metric data providers.

Study	Focus	Key findings
Robinson-García et al. (2014)	Altmetric.com coverage	Only 19% of papers covered; top sources account for 95.5% of mentions.
Fang and Costas (2020)	Data gathering velocity	Data accumulation varies; news and social media are faster than Wikipedia.
Ortega (2018b)	PlumX metrics lifecycle	Mentions are the earliest metrics; downloads have the longest lifecycle.
Yu et al. (2022)	Accuracy of news mentions in Altmetric.com	42.5% error rate in news mentions; common errors include inaccessible articles.
Fleerackers et al. (2022)	Recall and precision of news mentions	Altmetric.com data is relatively accurate with high precision.
Ortega (2018a)	Comparison of Altmetric.com, PlumX, CED	Significant differences in coverage; Altmetric.com excels in social media.
Zahedi and Costas (2018)	Data quality across five providers	Significant differences in data quality; varies by platform and collection method.
Karmakar et al. (2021)	Coverage and mentions on Altmetric.com and PlumX	PlumX covers more sources; Altmetric.com excels in Twitter and blogs.
Gong et al. (2022)	Quality of alternative metrics data	Altmetric.com performs better on Twitter; PlumX excels in Wikipedia citations.

Table 1 summarizes key findings from selected studies, highlighting their contributions and limitations.

METHODOLOGY

This study has a descriptive and explorative nature aimed to determine whether using a specific alternative metrics data provider can make a significant difference in an alternative metrics analysis. Therefore, Altmetric.com and PlumX, as the most commonly used alternative metrics data providers, were chosen for the study (Gong et al., 2022; Karmakar et al., 2021). Lists of hot papers (exported on 4 January 2024) provided by InCites Essential Science Indicators (dataset updated on 9 November 2023) were used as the sample for the study. There are two main reasons for choosing this sample; first, these publications were not limited to a specific subject area; and second, they are likely to have received considerable attention from the research community, which increases the likelihood of capturing a diverse range of alternative metrics data.

Hot papers are defined as those that receive a rapid and significant number of citations shortly after publication, typically within a 2-month period. The InCites Essential Science Indicators dataset analyses papers published in the last 2 years, measuring their citation counts against established thresholds specific to their respective fields. Each field is treated separately to account for variations in citation rates, and citation frequency distributions are compiled to determine the top 0.1% of papers in each category.[2] Consequently, hot papers represent those that have captured the interest of the scientific community and potentially beyond, reflecting their significance and impact. It can be said that these hot papers receive 'considerable attention', which not only indicates increased citation rates but also suggests heightened visibility on platforms such as social media, where impactful research often garners discussion.

In the data collection process, a list of 4236 hot papers was downloaded from the InCites Essential Science Indicators database. Then, the same metrics data from each data provider along with citation count in Scopus and Dimensions were extracted and recorded for each paper. The data providers did not supply alternative metrics data for all records, resulting in the extraction of data for 4226 papers from PlumX and 3204 papers from Altmetric.com. The required alternative metrics data from Altmetric.com were collected through Altmetric Explorer. However, the authors had no access to PlumX and required data from this source for each DOI were extracted manually using the link (https://plu.mx/plum/a/?doi=10.1002/leap.1631) (Fig. 1). All data from these two sources were collected on 4–7 January 2024.

The collected data were analysed using SPSS software to conduct both descriptive and inferential analyses. Mean, median, and standard deviation were calculated for each alternative metric (policy citations, Mendeley readers, Wikipedia mentions, blog

[2]https://images.webofknowledge.com/images/help/WOS/hs_citation_applications.html.

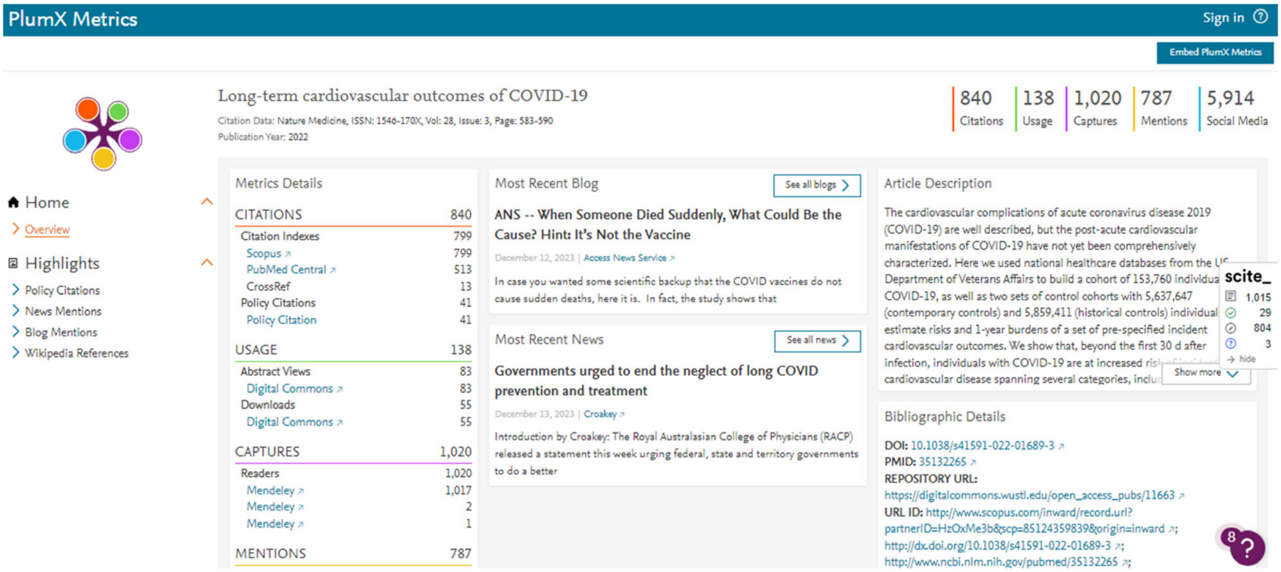

FIGURE 1 Extracting alternative metrics data from PlumX.

mentions, Facebook mentions, and news mentions) separately for data from Altmetric.com and PlumX, providing an overview of the central tendency and dispersion of each metric within each provider. Wilcoxon signed-rank test was used to compare the differences in medians for each alternative metric between Altmetric.com and PlumX data. This non-parametric test is suitable for situations where data may not be normally distributed, which is often the case with alternative metrics data. Spearman's rank correlation coefficient was calculated to assess the strength and direction of the relationship between citation counts (from Scopus) and each alternative metric for both data providers. This non-parametric correlation test is appropriate for ordinal data such as rankings or counts.

FINDINGS

The analysis of the collected alternative metrics data from Altmetric.com and PlumX revealed intriguing insights into the potential differences between data providers and the interplay between citations and alternative metrics mentions. This section delves into the key findings obtained through descriptive and inferential statistical analyses.

Table 2 illustrates the relationship between citation counts and diverse alternative metrics. Analysed using Spearman's correlation test with data from both PlumX and Altmetric.com, it reveals a noteworthy trend: both providers show statistically significant positive correlations ($p < 0.01$) between the number of citations and all six alternative metrics examined. Based on data from both alternative metrics providers, Mendeley readers show the strongest correlation with Scopus citation counts, while other alternative metrics exhibit weak correlations with citation counts.

Analysing alternative metrics data from PlumX and Altmetric.com (Table 3) reveals some interesting patterns. While PlumX reports the highest number of Facebook mentions, Altmetric.com has the lowest coverage of Facebook mentions. This suggests differing coverage of Facebook mentions between the two

TABLE 2 Correlation between citation count and alternative metrics using PlumX and Altmetric.com data.

	PlumX			Altmetric.com		
Alternative metrics	*N*	Correlation coefficient	Sig. (2-tailed)	*N*	Correlation coefficient	Sig. (2-tailed)
Policy citations/mentions	4226	0.335**	0.000	3204	0.288**	0.000
Mendeley readers	4226	0.728**	0.000	3204	0.711**	0.000
Wikipedia mentions	4225	0.279**	0.000	3204	0.253**	0.000
Blog mentions	4224	0.187**	0.000	3204	0.247**	0.000
Facebook mentions	4225	0.282**	0.000	3204	0.226**	0.000
News mentions	4225	0.336**	0.000	3204	0.272**	0.000

** Correlation is significant at the 0.01 level (2-tailed).

TABLE 3 Descriptive statistics on the alternative metrics in PlumX and Altmetric.com.

	PlumX				Altmetric.com			
Alternative metrics	***N***	**Mean**	**Median**	**Standard deviation**	***N***	**Mean**	**Median**	**Standard deviation**
Scopus citations	4226	132.48	82	204.84	-	-	-	-
Dimensions citations	-	-	-	-	3204	189.63	116	31,307
Policy citations/mentions	4226	1.49	0	10.31	3204	0.48	0	2.68
Mendeley readers	4226	198.16	86	386.85	3204	252.46	134	433.00
Wikipedia mentions	4225	0.84	0	19.20	3204	1.08	0	21.68
Blog mentions	4224	0.83	0	3.30	3204	2.28	0	6.76
Facebook mentions	4225	634.23	0	10,466.96	3204	1.05	0	2.58
News mentions	4225	22.40	0	128.36	3204	39.22	1	139.31

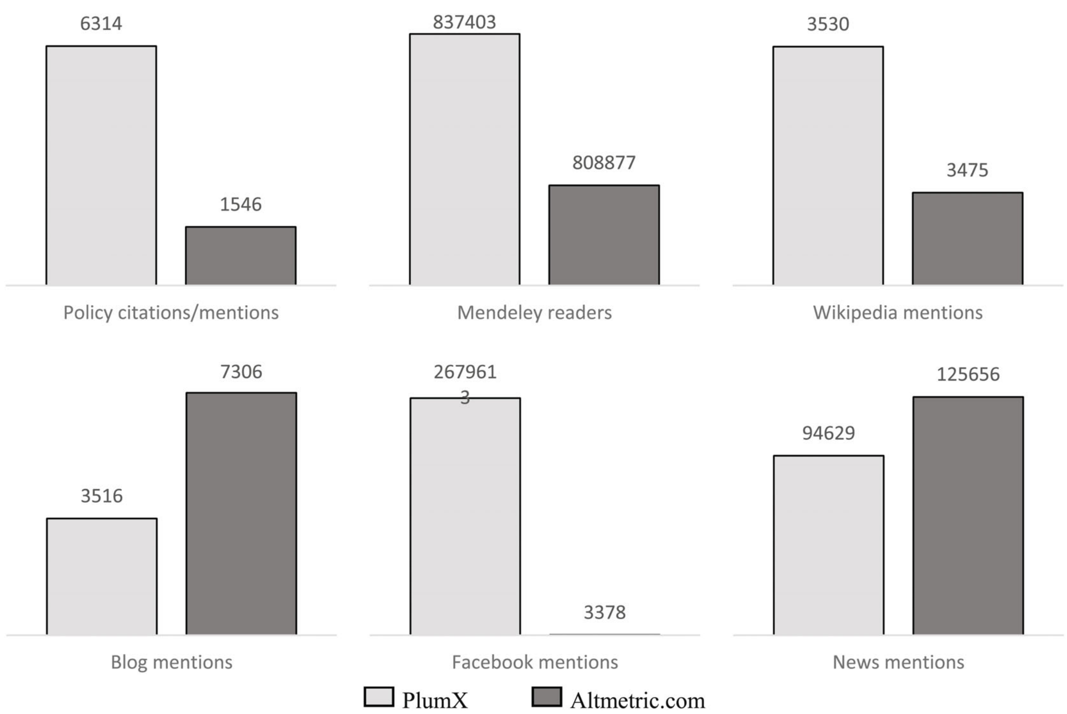

FIGURE 2 Sum of values of alternative metrics from PlumX and Altmetric.com.

alternative metrics data providers. However, when it comes to Mendeley readers, Wikipedia mentions, blog mentions, and news mentions, PlumX reports lower values compared to Altmetric.com, hinting at potential differences in how these providers capture these specific metrics. The significant gap in Mendeley readers, Facebook mentions, and news mentions between the two alternative metrics data providers highlight the substantial variation in how each platform captures social media attention. Additionally, Fig. 2 presents a comparative analysis of mean values for various alternative metrics sourced from two platforms. Based on the solution presented by Thelwall (2021) for calculating arithmetic means in research on societal impact measurement, geometric means were calculated. The results showed a zero value for all alternative metrics across two alternative metrics data providers.

A deeper analysis of the descriptive data on the differences between the two alternative metrics data providers, as shown in Table 4, presented in Table 3 and Fig. 2, using Wilcoxon's non-parametric statistical test, confirms statistically significant differences between Altmetric.com and PlumX data across all six analysed indicators.

Table 5 focuses on how publications from different research fields are covered in social media through the lens of two platforms. It dissects six key alternative metrics for each of 22 broad research fields, based on the Essential Science Indicators schema. This table presents a comparative analysis of alternative metrics

TABLE 4 Statistical difference analysis between alternative metrics in PlumX and Altmetric.com.

	Policy mentions	Mendeley readers	Wikipedia mentions	Blog mentions	Facebook mentions	News mentions
Z	−20.211[a]	−41.106[a]	−2.705[a]	−24.450[a]	−24.317[a]	−20.768[a]
Sig. (2-tailed)	0.000	0.000	0.007	0.000	0.000	0.000

[a] Based on positive ranks.

across various research fields as reported by PlumX and Altmetric.com; cells containing higher mean values across two alternative metrics providers have been highlighted in light grey, identifying the metrics that demonstrate greater attention within each field across two data providers.

According to Table 5, certain fields exhibit a clear bias towards one platform. For instance, 'Environment/Ecology' leans heavily towards Altmetric.com for news mentions, hinting at platform-specific strengths in capturing different types of attention. Geometric mean values for all alternative metrics, except for Mendeley readers, were zero across all research fields on both Altmetric.com and PlumX. However, based on the data provided by both alternative metrics platforms, 'Molecular Biology & Genetics' had the highest geometric mean among the research fields.

Table 6 shows the results of a statistical difference analysis (Wilcoxon's non-parametric test) between the number of alternative metrics reported by PlumX and Altmetric.com in different academic fields. The comparison aims to assess the variations and significance of these indicators across different fields. In this table, cells showing significant statistical difference have been highlighted in light grey.

According to Table 6, the difference between alternative metrics reported by PlumX and Altmetric.com are statistically significant in most academic fields. However, the magnitude of the differences varies across fields. For instance, the differences between the two platforms are particularly pronounced for 'Immunology' and 'Chemistry', while the differences are smaller for 'Mathematics'. The statistical analysis also revealed that some of the differences between alternative metrics reported by PlumX and Altmetric.com are not statistically significant. For example, the differences in Wikipedia mentions are not statistically significant for most fields. The results for blog mentions are also mixed.

DISCUSSION AND CONCLUSION

Various studies have analysed different aspects of the data from alternative metrics providers, often yielding differing results. For instance, Yu et al. (2022) questioned the reliability of news mention data in Altmetric.com, while Fleerackers et al. (2022) have verified its precision. A consensus is evident among studies regarding the discrepancies in the values (counts) provided for each indicator among alternative metrics data providers, which can lead to different descriptive statistical analyses. This study, similar to others (Gong et al., 2022; Karmakar et al., 2021; Ortega, 2018a, 2018b; Zahedi & Costas, 2018), highlights potential discrepancies between Altmetric.com and PlumX, particularly in capturing specific online attention metrics. There is no clear answer in the literature regarding whether using Altmetric.com or PlumX significantly affects inferential statistical analyses across different academic fields. The primary contributions of this research include employing various correlation and difference statistical tests to compare the two major alternative metrics data providers, both overall and at the subject level, using a distinct sample—hot papers.

Consistent with Karmakar et al. (2021), this study found that PlumX covers a higher percentage of hot papers (99.7%) compared to Altmetric.com (75.8%). The results indicated that in some research fields, the coverage of hot papers by PlumX and Altmetric.com is either equal or very low. These fields include 'Microbiology', 'Immunology', 'Multidisciplinary', 'Neuroscience & Behavior', 'Space Science', 'Molecular Biology & Genetics', and 'Psychiatry/Psychology'. The greatest difference between the two alternative metrics databases is in 'Engineering', where out of 567 hot papers, only 267 (47%) are covered by Altmetric.com, while PlumX covers all of them. This suggests that in some research fields, researchers seeking greater coverage for their sample articles might prefer PlumX over Altmetric.com.

The study indicates that using either Altmetric.com or PlumX does not significantly affect the positive correlation between alternative metrics and citation counts. However, there are slight differences in the degree of correlation depending on the platform. For instance, PlumX shows slightly stronger correlations between citation counts and metrics like policy mentions, Mendeley readers, Wikipedia mentions, Facebook mentions, and news mentions. By contrast, Altmetric.com data shows a stronger correlation with blog mentions. These discrepancies warrant further investigation into potential variations in how each platform tracks and measures these online mentions. Previous studies have also reported positive correlations between citation counts and alternative metrics (Akoglu, 2018; Costas et al., 2015; Thelwall et al., 2013). Therefore, reviewers or users of alternative metrics studies should not be overly concerned about the impact of different alternative metrics data providers on the correlation between alternative metrics and citation counts.

This study, along with previous research (Gong et al., 2022; Karmakar et al., 2021; Ortega, 2018a, 2018b; Zahedi & Costas, 2018), indicates significant statistical differences in the alternative metric data provided by PlumX and Altmetric.com. The statistical tests in this study confirmed that these differences are significant across all alternative metrics. While Altmetric.com reports higher mean values for Mendeley readers, Wikipedia mentions, blog mentions, and news mentions, PlumX reports higher mean values for policy citations and Facebook mentions. However, due to the skewed nature of alternative metrics data,

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TABLE 5 Comparative analysis of alternative metrics' value across research fields: PlumX versus Altmetric.com.

	PlumX													Altmetric.com												
		Policy mentions		Mendeley readers		Wikipedia mentions		Blog mentions		Facebook mentions		News mentions			Policy mentions		Mendeley readers		Wikipedia mentions		Blog mentions		Facebook mentions		News mentions	
Research fields	*N*	Mn*	Md#	Mn	Md	Mn	Md	Mn	Md	Mn	Md	Mn	Md	*N*	Mn	Md	Mn	Md	Mn	Md	Mn	Md	Mn	Md	Mn	Md
Agricultural Sciences	108	2.64	0.00	149.25	87.00	0.54	0.00	0.75	0.00	26.96	0.00	7.75	0.00	77	0.40	0.00	201.16	155.00	0.82	0.00	1.31	0.00	0.35	0.00	22.38	0.00
Biology & Biochemistry	177	0.20	0.00	284.66	183.00	0.75	0.00	0.62	0.00	30.20	0.00	6.27	1.00	162	0.04	0.00	317.58	209.00	0.79	0.00	1.78	0.00	0.93	0.00	13.69	1.00
Chemistry	448	0.12	0.00	106.78	44.00	0.17	0.00	0.16	0.00	7.16	0.00	1.32	0.00	364	0.05	0.00	131.30	61.00	0.24	0.00	0.26	0.00	0.20	0.00	3.52	0.00
Clinical Medicine	703	3.09	0.00	343.43	194.00	0.67	0.00	1.64	0.00	2095.74	2.00	75.44	6.00	682	1.11	0.00	360.49	208.50	0.67	0.00	4.24	1.00	2.25	1.00	89.85	12.50
Computer Science	133	0.28	0.00	228.68	57.00	0.14	0.00	0.11	0.00	3.17	0.00	0.92	0.00	84	0.12	0.00	346.67	202.00	0.30	0.00	0.19	0.00	0.00	0.00	1.37	0.00
Economics & Business	77	16.70	0.00	298.97	156.00	0.12	0.00	0.53	0.00	15.21	0.00	2.34	0.00	53	3.64	0.00	392.81	254.00	0.19	0.00	0.91	0.00	0.08	0.00	5.92	0.00
Engineering	567	0.11	0.00	169.49	46.00	0.09	0.00	0.13	0.00	5.48	0.00	0.64	0.00	267	0.04	0.00	297.17	122.00	0.21	0.00	0.29	0.00	0.07	0.00	3.18	0.00
Environment/Ecology	229	2.38	0.00	161.41	62.00	5.66	0.00	1.84	0.00	379.57	0.00	27.14	0.00	150	0.79	0.00	226.22	125.50	8.71	0.00	4.01	0.00	0.97	0.00	68.50	0.50
Geosciences	142	2.09	0.00	150.11	78.00	1.06	0.00	2.46	0.00	31.86	0.00	33.49	0.00	95	0.61	0.00	212.23	144.00	1.74	0.00	5.97	1.00	1.06	0.00	82.41	2.00
Immunology	66	3.76	0.00	294.15	209.50	0.95	0.00	1.15	0.00	6,107.79	5.50	26.88	3.00	65	0.94	0.00	305.05	226.00	1.22	0.00	3.34	1.00	1.83	1.00	80.66	8.00
Materials Science	303	0.05	0.00	115.52	62.00	0.13	0.00	0.21	0.00	5.50	0.00	1.71	0.00	219	0.01	0.00	150.42	93.00	0.18	0.00	0.53	0.00	0.32	0.00	6.42	0.00
Mathematics	105	0.00	0.00	22.26	3.00	0.01	0.00	0.11	0.00	3.52	0.00	0.05	0.00	23	0.00	0.00	74.65	12.00	0.04	0.00	0.04	0.00	0.00	0.00	0.04	0.00
Microbiology	63	2.41	0.00	292.59	187.00	0.95	0.00	1.19	0.00	96.76	0.00	43.40	2.00	63	0.63	0.00	297.65	194.00	1.11	0.00	2.32	0.00	1.71	0.00	41.29	4.00
Molecular Biology & Genetics	99	2.29	0.00	400.52	329.00	1.15	0.00	2.02	0.00	2,162.44	34.00	55.63	5.00	97	0.35	0.00	414.28	332.00	1.16	0.00	4.74	1.00	2.95	2.00	95.63	8.00
Multidisciplinary	15	2.87	0.00	169.67	108.00	0.47	0.00	1.47	0.00	75.13	0.00	31.33	4.00	14	1.29	0.00	185.79	133.00	0.57	0.00	3.00	2.00	1.50	1.00	60.86	16.00
Neuroscience & Behavior	107	1.06	0.00	318.16	220.00	0.96	0.00	1.94	0.00	440.34	0.00	85.15	6.00	106	0.25	0.00	328.50	225.00	1.09	0.00	5.27	1.00	2.48	1.00	85.06	10.00
Pharmacology & Toxicology	112	0.21	0.00	179.83	97.50	0.25	0.00	0.35	0.00	20.91	0.00	5.66	0.00	101	0.12	0.00	203.69	111.00	0.30	0.00	0.46	0.00	0.85	0.00	7.23	0.00
Physics	206	0.13	0.00	93.79	43.50	0.47	0.00	0.62	0.00	29.24	0.00	3.79	0.00	145	0.02	0.00	128.32	83.00	0.69	0.00	1.72	0.00	0.52	0.00	11.95	1.00
Plant & Animal Science	176	0.18	0.00	84.81	57.50	2.49	0.00	0.28	0.00	31.27	0.00	4.81	0.00	149	0.07	0.00	99.30	73.00	2.52	0.00	0.87	0.00	0.77	0.00	8.17	0.00
Psychiatry/Psychology	125	2.76	0.00	213.80	129.00	0.29	0.00	1.26	0.00	191.94	0.00	24.38	1.00	123	0.41	0.00	225.45	136.00	0.30	0.00	2.30	0.00	0.81	0.00	33.18	2.00
Social Sciences, General	231	1.36	0.00	169.45	74.00	0.27	0.00	0.39	0.00	1,676.16	0.00	5.96	0.00	132	0.64	0.00	228.89	106.50	0.52	0.00	1.39	0.00	0.44	0.00	14.19	0.00
Space Science	34	0.00	0.00	62.71	52.00	6.41	1.00	2.41	0.00	2.32	0.00	18.38	2.00	33	0.00	0.00	65.12	51.00	4.24	2.00	5.45	2.00	0.61	0.00	52.85	9.00

* Mean.
# Median.

TABLE 6 Statistical difference analysis between alternative metrics in PlumX and Altmetric.com across academic fields.

Fields	Test statistics	Policy mentions	Mendeley readers	Wikipedia mentions	Blog mentions	Facebook mentions	News mentions
Agricultural Sciences	Z	−3.442[a]	−7.194[b]	−0.720[b]	−1.373[b]	−4.460[a]	−4.289[b]
	Sig. (2-tailed)	0.001	<0.001	0.472	0.170	<0.001	<0.001
Biology & Biochemistry	Z	−3.896[a]	−10.416[b]	−0.484[a]	−6.513[b]	−4.140[a]	−3.975[b]
	Sig. (2-tailed)	<0.001	<0.001	0.628	<0.001	<0.001	<0.001
Chemistry	Z	−3.352[a]	−14.110[b]	−2.271[b]	−2.573[b]	−5.073[a]	−4.750[b]
	Sig. (2-tailed)	0.001	<0.001	0.023	0.01	<0.001	<0.001
Clinical Medicine	Z	−10.718[a]	−16.667[b]	−1.511[a]	−16.443[b]	−14.544[a]	−8.467[b]
	Sig. (2-tailed)	<0.001	<0.001	0.131	<0.001	<0.001	<0.001
Computer Science	Z	−2.235[a]	−7.224[b]	−1.342[b]	−0.504[b]	−2.810[a]	−0.145[b]
	Sig. (2-tailed)	0.025	<0.001	0.180	0.614	0.005	0.885
Economics & Business	Z	−3.517[a]	−6.095[b]	−0.272[b]	−0.811[b]	−3.297[a]	−0.290[b]
	Sig. (2-tailed)	<0.001	<0.001	0.785	0.417	0.001	0.772
Engineering	Z	−3.968[a]	−12.045[b]	−1.633[b]	−0.984[b]	−4.604[a]	−6.400[b]
	Sig. (2-tailed)	<0.001	<0.001	0.102	0.325	<0.001	<0.001
Environment/Ecology	Z	−5.978[a]	−9.842[b]	−1.344[b]	−5.279[b]	−5.154[a]	−6.029[b]
	Sig. (2-tailed)	<0.001	<0.001	0.179	<0.001	<0.001	<0.001
Geosciences	Z	−5.164[a]	−6.693[b]	−1.897[b]	−4.922[b]	−4.323[a]	−4.582[b]
	Sig. (2-tailed)	<0.001	<0.001	0.058	<0.001	<0.001	<0.001
Immunology	Z	−4.812[a]	−5.716[b]	−2.064[b]	−4.859[b]	−5.100[a]	−5.242[b]
	Sig. (2-tailed)	<0.001	<0.001	0.039	<0.001	<0.001	<0.001
Materials Science	Z	−1.604[a]	−11.659[b]	0.000d	−3.523[b]	−2.384[a]	−7.084[b]
	Sig. (2-tailed)	0.109	<0.001	1.000	<0.001	0.017	<0.001
Mathematics	Z	0.000[a]	−2.567[b]	0.000[a]	−1.000d	−1.342d	−0.447d
	Sig. (2-tailed)	1.000	0.01	1.000	0.317	0.18	0.655
Microbiology	Z	−4.390[a]	−6.303[b]	−1.641[b]	−2.524[b]	−4.763[a]	−3.311[b]
	Sig. (2-tailed)	<0.001	<0.001	0.101	0.012	<0.001	0.001
Molecular Biology & Genetics	Z	−4.127[a]	−7.463[b]	−0.593[a]	−6.292[b]	−6.824[a]	−4.779[b]
	Sig. (2-tailed)	<0.001	<0.001	0.553	<0.001	<0.001	<0.001
Multidisciplinary	Z	−2.032[a]	−3.074[b]	−1.000[b]	−1.786[b]	−1.203[a]	−2.073[b]
	Sig. (2-tailed)	0.042	0.002	0.317	0.074	0.229	0.038
Neuroscience & Behavior	Z	−3.972[a]	−7.224[b]	−1.409[b]	−6.667[b]	−5.941[a]	−3.850[b]
	Sig. (2-tailed)	<0.001	<0.001	0.159	<0.001	<0.001	<0.001
Pharmacology & Toxicology	Z	−2.232[a]	−7.839[b]	−0.707[b]	−0.068[a]	−3.748[a]	−2.970[b]
	Sig. (2-tailed)	0.026	<0.001	0.480	0.946	<0.001	0.003
Physics	Z	−3.108[a]	−8.580[b]	−1.155[b]	−4.199[b]	−3.390[a]	−6.059[b]
	Sig. (2-tailed)	0.002	<0.001	0.248	<0.001	0.001	<0.001
Plant & Animal Science	Z	−2.742[a]	−9.223[b]	−0.575[a]	−4.665[b]	−3.402[a]	−4.612[b]
	Sig. (2-tailed)	0.006	<0.001	0.565	<0.001	0.001	<0.001

TABLE 6 Continued

Fields	Test statistics	Policy mentions	Mendeley readers	Wikipedia mentions	Blog mentions	Facebook mentions	News mentions
Psychiatry/Psychology	*Z*	−5.588[a]	−8.424[b]	−0.378[b]	−4.934[b]	−5.024[a]	−4.354[b]
	Sig. (2-tailed)	<0.001	<0.001	0.705	<0.001	<0.001	<0.001
Social Sciences, General	*Z*	−5.563[a]	−8.882[b]	−1.289[b]	−3.074[b]	−5.741[a]	−4.118[b]
	Sig. (2-tailed)	<0.001	<0.001	0.197	0.002	<0.001	<0.001
Space Science	*Z*	0.000[c]	−2.690[b]	−2.342[b]	−3.775[b]	−0.237[a]	−3.991[b]
	Sig. (2-tailed)	1.000	0.007	0.019	<0.001	0.812	<0.001

[a] Based on positive ranks.
[b] Based on negative ranks.
[c] The sum of negative ranks equals the sum of positive ranks.

the mean does not provide an accurate representation. Therefore, the geometric mean (Thelwall, 2021) or the median could offer a better solution. The analysis shows that the median values for alternative mentions, except for Mendeley readers and news mentions, are zero across both platforms. Similarly, the geometric mean shows that all selected alternative metrics in both databases are identical and equal to zero. Researchers should be aware that discrepancies between alternative metrics data providers can affect the interpretation of alternative metrics. For example, using PlumX data might lead to an overestimation of a study's social visibility due to higher Facebook mention counts. According to Zahedi and Costas (2018), these differences arise from various approaches to data collection, accumulation, reporting, and updating among different alternative metrics data providers. While Altmetric.com focuses on specific social media platforms, PlumX includes a broader range of attention metrics, such as comments, likes, and shares.

Thelwall (2021) pointed out that ignoring field differences and using arithmetic means are common problems in studies measuring societal impact. This study's comparative analysis of alternative metrics for hot papers across different research fields, based on data from Altmetric.com and PlumX, shows that the geometric mean, and the median alternative metrics across the two platforms are very similar, except for Mendeley readers and news mentions. However, differences emerge when looking at the mean alternative metrics. Altmetric.com generally reports higher mean values across research fields, except for policy mentions and Facebook mentions, where PlumX shows higher means. The study also highlights the popularity of specific fields on social media and illustrates different coverage of research fields by alternative metrics data providers. Statistical analysis reveals that PlumX and Altmetric.com data on Wikipedia mentions, and in the 'Mathematics' field (except for Mendeley readers), are not significantly different.

In addition to the discrepancies observed between Altmetric.com and PlumX, it is important to recognize that similar challenges have been documented in previous studies comparing traditional bibliometric databases (Meho & Rogers, 2008; Minasny et al., 2013; Singh et al., 2021). For instance, research has shown that citation counts can vary significantly among Web of Science, Scopus, Google Scholar, and Dimensions, as each database employs different indexing criteria and coverage policies. Furthermore, variations in the H-index, particularly within different versions of Web of Science, illustrate how the choice of database can influence the perceived impact of scholarly work.

This study offers a comprehensive overview of alternative metrics and the relevant data providers; however, it is important to contextualize these findings within the framework of the target audience. Different stakeholder groups—such as the general public, academic researchers, and policymakers—interact with research outputs in unique ways. For example, social media mentions may serve as a more relevant indicator of public interest, particularly for research with immediate societal implications, whereas policy citations may better reflect policy makers' attention. Therefore, it is imperative for future research to investigate how alternative metrics differ across various research fields and target audiences, thereby enriching our understanding of research impact and its multifaceted nature.

This study is subject to several limitations. First, the study's scope was limited by the small sample size and uneven distribution of subjects in the hot papers. Extending the sample to a broader range of publications could yield different results. Second, the study employed a cross-sectional design, limiting its ability to capture temporal variations in discrepancies between the two platforms. A longitudinal study would be beneficial in understanding how these differences evolve over time. Third, the analysis was constrained to six alternative metrics due to the limited scope of shared metrics between PlumX and Altmetric.com. Expanding the range of indicators would provide a more comprehensive understanding of the platforms' respective strengths and weaknesses. Additionally, it would be beneficial to expand the scope of the study to include other alternative metrics data providers. Different alternative metrics data providers may have access to varying data sources, resulting in differences in the indicators they report. Exploring the data coverage of various platforms can shed light on the breadth of attention signals captured by alternative metrics. As the field of alternative metrics develops, more platforms are emerging with unique data collection methods and coverage. Comparing the results of different platforms would provide a more comprehensive understanding of the alternative metrics landscape and how it reflects the diversity of research impact indicators.

In conclusion, our study underscores the importance of carefully selecting alternative metrics data providers based on the specific research context and attention metrics of interest. The findings reveal significant differences in the alternative metrics reported by PlumX and Altmetric.com, suggesting that relying on a single platform may lead to an incomplete or skewed understanding of research impact. Therefore, we recommend that alternative metrics researchers utilize multiple platforms to conduct their analyses. By doing so, they can capture a more comprehensive view of attention and impact, as each platform may highlight different aspects of dissemination and reach. This multi-platform approach will enable researchers to triangulate their findings, leading to more robust conclusions and a deeper understanding of how their work resonates across various audiences. Ultimately, embracing the diversity of alternative metrics data can enhance the accuracy and relevance of research impact assessments.

AUTHOR CONTRIBUTIONS

The first author collected and analyzed the data, while the second author designed the research and wrote the article.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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