Postprint: Analysis of Altmetrics Indicators for Academic Books

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Abstract

[Purpose/Significance] This study investigates the effectiveness of employing Altmetrics indicators to evaluate the impact of academic books and proposes reasonable recommendations for academic book evaluation. [Method/Process] Data were collected on Twitter mentions, Mendeley readership counts, online book review counts, and library holdings. Following an analysis of statistical measures such as coverage rates and quantiles of the dataset, correlation coefficient tests were conducted between citation counts and Altmetrics indicators. Subsequently, empirical analysis was performed on academic books with high Altmetrics indicator values, examining their temporal distribution, disciplinary differences, and book topics to explore the application of each indicator in evaluating academic book impact. [Results/Conclusion] Traditional bibliometric indicator citation counts exhibit low correlation with Altmetrics indicators, indicating that Altmetrics can serve as a novel perspective for academic book evaluation. Different Altmetrics indicators reflect distinct dimensions of academic book impact. Future academic book impact evaluation should incorporate characteristics such as publication year and discipline, combine traditional citation metrics with Altmetrics indicators, and explore a more comprehensive and effective evaluation mechanism.

Full Text

Preamble

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Analysis of Altmetrics Indicators for Academic Books
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Abstract

[**Purpose/Significance**] This study explores the effectiveness of Altmetrics indicators in evaluating the impact of academic books and proposes reasonable recommendations for academic book evaluation. [**Method/Process**] We collected data on Twitter mentions, Mendeley readership, online review counts, and library holdings. After analyzing coverage rates, quantiles, and other statistics, we conducted correlation coefficient tests between citation frequency and Altmetrics indicators. We then performed empirical analyses of high-Altmetrics books by publication year, disciplinary differences, and subject matter to investigate the application of each indicator in academic book impact evaluation. [**Result/Conclusion**] The low correlation between traditional citation metrics and Altmetrics indicators demonstrates that Altmetrics can provide a new perspective for academic book evaluation, with different Altmetrics indicators reflecting different dimensions of book impact. Future evaluation of academic book impact should incorporate book characteristics such as publication year and discipline, combining traditional citation metrics with Altmetrics indicators to explore a more comprehensive and effective evaluation mechanism.

Classification Number: G250
Keywords: Altmetrics, Academic Books, Impact Evaluation

As important manifestations of research output and carriers for transmitting academic thought, academic books possess strong scientific rigor, documenting and disseminating cutting-edge achievements in specific fields, and have long been regarded as significant scholarly contributions. However, with continuously expanding publication channels, the number of published academic books has grown rapidly, making selection a pressing issue and necessitating accurate and effective evaluation.

Current citation-based evaluation for academic papers is relatively mature, with domestic and international academic journals establishing hierarchical and categorical evaluation systems. Similar to journal articles, evaluating academic books through citations is also common, yet many books (in history, art, music, and literature) may have merits that traditional metrics (such as citation counts) cannot reflect. These indicators have not received due attention in existing academic evaluation systems, and many high-quality academic books fail to gain peer recognition due to lack of reasonable evaluation mechanisms, reducing the fairness of academic evaluation to some extent. It is difficult for authors to demonstrate the time invested in book production or to have their contributions recognized by peers.

Domestic and international evaluation methods for academic books also include peer review, where disciplinary experts assess book value based on their knowledge and experience. While comprehensive and authoritative, peer review is often limited by experts' personal knowledge and preferences, involves subjectivity and uncertainty, and faces challenges with large data volumes and poor feasibility, making it difficult to scientifically and effectively evaluate academic

book impact.

In 2011, Thomson Reuters (now Clarivate Analytics) released the BKCI database, providing more authoritative data sources for book citation evaluation. However, compared to papers, academic books require longer production time, have greater academic capacity, and greater academic depth. Traditional citation metrics from papers are insufficient for evaluating book impact. Additionally, differences in evaluation indicators and methods for different types of academic books should be considered. Taking the UK's 2014 Research Excellence Framework as an example, when evaluating research achievements in higher education institutions, humanities (48%) and social sciences (17%) books were more common than science and medicine (0.5%) books.

Therefore, to improve academic book impact evaluation mechanisms, it is necessary to explore new evaluation indicators, particularly diversified indicators emerging in new social and technological environments, to measure impact more comprehensively and broadly. Under new academic communication models, many studies have introduced Altmetrics as a new bibliometric method. Altmetrics can not only improve traditional journal paper evaluation indicators but also evaluate other academic outputs (such as books, software, and datasets). Compared with citation evaluation and peer review, Altmetrics data sources are more extensive, simultaneously addressing both academic and social impact of books, thus offering a new perspective for book evaluation.

Current application of Altmetrics in book evaluation is still developing. This study selects multiple indicators and combines them with book data for empirical analysis to explore the characteristics and differences of various indicators in reflecting impact dimensions.

Related Research

Preliminary discussions on applying Altmetrics indicators to academic book impact evaluation have emerged. Scholars have primarily proposed available Altmetrics indicators and data sources, exploring their innovation compared to traditional citation indicators when evaluating academic books. Some studies have analyzed specific indicators while comparing them with citation metrics to investigate which impact dimensions these Altmetrics indicators can reflect.

K. Kousha et al. found that the number of Amazon bestseller reviews had low correlation with citations, concluding that online reviews can reflect book popularity among general audiences. M. Thelwall et al. confirmed through Twitter indicator research that, compared with citation metrics, Twitter better reflects the breadth of academic output impact. K. Kousha et al. compared Goodreads indicators with citations and other metrics, finding low inter-indicator correlation, suggesting that reader ratings and review data on Goodreads can assess reader recognition and social credibility of academic books. A. Zuccala et al. studied books in two humanities fields and found a weak positive correlation between libcitation and Scopus citations, proving that library collection

statistics can reflect educational and cultural impact different from citations. These studies have confirmed the availability of various Altmetrics indicators in academic book impact research while revealing the impact dimensions reflected by specific indicators.

Some scholars have focused on constructing academic book impact evaluation systems based on theoretical impact dimension divisions, introducing partial Altmetrics indicators to supplement and improve the system, providing new perspectives for book evaluation. Qiu Junping et al. proposed an impact generation model including perception, social media, and application layers, with social media as the core of Altmetrics. In existing academic book impact evaluation systems, Altmetrics has begun to be preliminarily applied as a new dimension. Zhang Yu et al. categorized 27 indicators into four dimensions: book utilization, online reviews, book citations, and funding/awards, introducing online review and holdings indicators based on traditional citation evaluation. He Jun et al. evaluated Chinese books from content quality and editorial quality perspectives, establishing online download frequency indicators to reflect book dissemination on the internet. Lin Xiaohua constructed an e-book academic impact evaluation system based on Altmetrics tools, divided into citation, online mention/reader tags, usage, and online review metrics, with multiple secondary data sources under each dimension. These evaluation systems combine quantitative and qualitative evaluation. However, quantitative evaluation is often limited by indicator completeness, and data accuracy may bias results; qualitative evaluation relies on expert scoring with strong randomness and subjectivity, making widespread application difficult. Moreover, existing book impact evaluation systems rarely explain indicator acquisition methods and lack in-depth exploration of some Altmetrics indicators' availability, leaving questions about whether inter-indicator correlations exist for aggregation.

To specifically study indicator content, scholars have analyzed particular indicators with data and compared them with citation metrics. However, such research often focuses on single indicators, lacking comparative analysis among different Altmetrics indicators, making it difficult to measure book impact from multiple dimensions.

Overall, when evaluating academic book impact, Altmetrics indicators have been preliminarily applied as a new dimension beyond citation metrics. However, existing evaluation systems lack necessary data support, and indicator weights are difficult to determine, leaving their availability to be verified. Some scholars' empirical analyses using specific indicators cannot demonstrate the multi-dimensionality of Altmetrics indicators in reflecting academic book impact due to indicator singularity. Therefore, this study selects multiple Altmetrics indicators and conducts empirical analysis with disciplinary book data to reveal the connotations and characteristics of each indicator for evaluating book impact.

Data Acquisition and Research Methods

Academic book impact is complex and multidimensional. Existing research roughly defines it as academic impact reflecting scholar recognition and social impact reflecting public attention. Evaluating only academic impact through citations or peer review has limitations in today's open scientific evaluation environment. Therefore, to explore more effective evaluation mechanisms, we collected 7,128 books from BKCI published between 2005-2015 across five disciplines: biochemistry, chemistry, engineering, history, and psychology, extracting their ISBNs and total citation frequencies. Using ISBNs, we obtained Twitter mention counts and Mendeley readership from Altmetric.com, online review counts from Goodreads, and holdings data from WorldCat, aiming to evaluate academic book impact from multiple academic and social perspectives. The four Altmetrics indicators were selected for the following reasons:

Table 1 shows the coverage rates of Altmetrics indicators by discipline. Twitter mentions refer to tweets and retweets mentioning a book. Given that many users share opinions about academic books on Twitter, this indicator effectively reflects book attention on social media. Mendeley is an online academic social network whose readership data can reflect researchers' reading behavior, thereby measuring academic attention and impact within respective fields. Goodreads hosts tens of millions of reviews and ratings, providing data to explore book impact from the general reader dimension. Libraries consider multiple factors including authors, users, and publishers when acquiring books, so holdings data from WorldCat can comprehensively measure book impact.

Based on these four indicators, this study analyzes their connotations and characteristics and conducts empirical research on typical books to deeply explore the availability of Altmetrics indicators for evaluating academic book impact. First, we use coverage rates, quantiles, and other statistics to describe the dataset and employ Spearman correlation tests to analyze relationships between traditional citation metrics and Altmetrics indicators. Second, we select the top 100 books by each Altmetrics indicator to analyze publication year distribution and disciplinary differences. Finally, we select the top five books for each indicator to analyze subjects and deeply discuss the characteristics and availability of Altmetrics indicators in reflecting academic book impact.

Altmetrics Indicator Statistical Analysis

Coverage rate, the ratio of books with non-zero Altmetrics indicator values to all books in the dataset, is crucial for measuring data completeness. Higher coverage indicates broader reflection of academic books and stronger indicator availability. Table 1 shows coverage rates by discipline. Psychology has slightly higher coverage in Twitter mentions and Mendeley readership than other disciplines; biochemistry has the largest proportion of online review data; all five disciplines exceed 90% coverage for holdings. Except for holdings, other indicators have relatively low coverage, suggesting Altmetrics indicators vary by

discipline and reflect limited academic book ranges, thus serving only as supplementary tools to citation metrics.

Figure 1 [Figure 1: see original paper] shows the distribution of Altmetrics indicator data. Except for holdings, all indicators have low medians and dispersed distributions, proving only a minority of academic books have high indicator values, enabling characteristic analysis of publication year, discipline, and content for these books to study each indicator's role in academic book impact evaluation.

In current journal paper evaluation, many studies have analyzed correlations between traditional citation metrics and Altmetrics indicators to explore combined impact evaluation feasibility, yet this is rarely addressed in academic book impact research. To ensure data validity and analysis clarity, we conducted Spearman correlation tests between citations and four Altmetrics indicators based on K-S test results, with correlation results shown in **Table 2** .

Table 2 Correlation Test Between Citation Frequency and Altmetrics Indicators

	Sig. (two-tailed)	N (sample size)	Twitter mentions	Mendeley readership	Online review count
Twitter mentions	-.108**				
Mendeley readership	.097**				
Online review count	-.003	.051**			

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

Correlation analysis shows significant relationships between Twitter mentions, Mendeley readership, holdings, and citation frequency, while online review counts show no correlation with citations. Although citation frequency correlates significantly with some Altmetrics indicators, the correlation coefficients are low, indicating weak associations. Statistically, this shows that while relationships exist, they are not strong, demonstrating that Altmetrics and citation metrics differ to some degree in measuring academic book impact. This confirms that using Altmetrics indicators for academic book impact evaluation can supplement existing citation-based evaluation.

High Altmetrics Indicator Typical Book Analysis

To further understand how Altmetrics indicators reflect academic book impact, we selected the top 100 books by each of four indicators, analyzing them from

publication year distribution and disciplinary differences, then examined the top five books by each indicator to explore their subjects and characteristics more comprehensively.

5.1 Publication Year Distribution of High Altmetrics Indicator Books

Selecting the top 100 books by holdings, online review counts, Twitter mentions, and Mendeley readership, we created stacked bar charts by publication year, shown in **Figure 2** [Figure 2: see original paper].

For the Twitter mention indicator on mass social media, books published in 2013-2015 account for a large proportion, indicating recently published academic books receive more public attention and discussion. This aligns with reality: in today's internet era, social media develops rapidly with wide influence, so readers tend to follow trends and discuss recently published books. This demonstrates the strong timeliness of academic books mentioned on social media. Therefore, social media indicators can promptly reflect real-time popularity and dissemination breadth of academic books in society.

For online review counts, books published in 2010 and 2011 received relatively more reviews, while recently published books from 2014-2015 had lower indicator values. Reviews often represent reflections after complete reading, more detailed than simple social media mentions. Book distribution and reader ordering/reading require time, so earlier publications accumulate more review information. Overall, online review counts can reflect academic book attention among the public from a more detailed perspective.

For library holdings, books published in 2015 account for a small proportion, and temporal changes in book percentages are less significant than for Twitter mentions. This indicates libraries prefer to collect classic books, paying relatively limited attention to social popularity. Evaluating and collecting books requires time, making immediate collection of new books difficult, thus creating certain lags for new titles. Therefore, holdings can evaluate the authority and recognition of academic books.

Comparing these three Altmetrics indicators, Mendeley readership shows far fewer books from 2014-2015 than Twitter mentions but slightly more than online review counts. This suggests that while information diffusion sensitivity is lower than social software and coverage is less than academic institutions like libraries, online academic exchange platforms show stronger sensitivity to "younger" books than review websites. Users' reading ranges include both classic works and recent research. Thus, Mendeley readership is a relatively sensitive indicator for measuring academic book impact.

5.2 Disciplinary Differences in High Altmetrics Indicator Books

Selecting the top 100 books by Twitter mentions, Mendeley readership, online review counts, and holdings, we created disciplinary bar charts, shown in **Figure**

3 [Figure 3: see original paper].

For Twitter mentions, books from all five disciplines received varying degrees of mention, reflecting social media's large user base encompassing readers from different fields with diverse interests. History and psychology books ranked higher in mentions, indicating readable, practical content attracts more general reader attention. Therefore, social media indicators better reflect reading tendencies of large reader groups.

For Mendeley readership, books from various disciplines are relatively evenly distributed among high-indicator books, with biochemistry, engineering, and psychology occupying larger proportions. Unlike other indicators, history books are mentioned less frequently by academic researchers. This suggests that in academic fields, applied natural science disciplines with faster theoretical updates attract more scholar attention and reading, while history, a social science with steadier development and longer research cycles, receives less reading and discussion. This difference may also relate to user disciplinary distribution on Mendeley, where history researchers may use the platform less.

History books dominate high-indicator books for online review counts (84%), with psychology second and other disciplines minimal. This shows academic books' social impact relates to disciplinary specialization and social relevance. History books are accessible, with content easily understood by general readers who can form reading insights and judgments about value. Psychology books address contemporary issues like stress and communication, integrating professional knowledge into daily life and resonating with readers, thus gaining attention.

Libraries predominantly collect history books, followed by psychology, with other disciplines minimal. History and psychology books have broad research areas and are readable, with audiences closer to library user groups, making them more collection-worthy. Therefore, library indicators better reflect academic book impact in education and culture fields close to general audiences.

This research explores disciplinary differences and temporal distribution based on high Altmetrics indicator books but mentions user groups behind each indicator only briefly. Future research could combine user characteristic data for each indicator (e.g., user identity and location for Twitter, user nationality and education for Mendeley, reviewer identity for Goodreads, and specific library collection information for holdings) to analyze user differences and broaden academic book evaluation approaches.

5.3 Top 5 Altmetrics Indicator Empirical Analysis

Since only a minority of academic books have high indicator values, we selected the top five books by each Altmetrics indicator for empirical analysis of their disciplinary and content characteristics to explore each indicator's features in reflecting book impact.

Table 3 Top 5 Books by Altmetrics Indicators

Indicator	Top 5 Books
Twitter mentions	*Make It New: The History of Silicon Valley Design* (History); *Bulk Collection of Signals Intelligence: Technical Options* (Engineering); *Stack: On Software and Sovereignty* (History); *Idealism beyond borders: the French revolutionary Left and the rise of humanitarianism* (History); *Molecular and Cellular Regulation of Adaptation to Exercise* (Biochemistry)
Mendeley readership	*Introductory Time Series with R* (Engineering); *Solar Engineering of Thermal Processes* (Engineering); *E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning* (Psychology); *Handbook of Cloud Computing* (Engineering); *Chromatin immunoprecipitation assays: methods and protocols* (Biochemistry)
Online review count	*The Whites of Their Eyes: The Tea Party's Revolution and the Battle over American History* (History); *A Farewell to Alms: A Brief Economic History of the World* (History); *Invisible Hook: The Hidden Economics of Pirates* (History); *Black Against Empire: The History and Politics of the Black Panther Party* (History); *Tambora: The Eruption That Changed the World* (History)

Indicator	Top 5 Books
Holdings	*Scepter of Judah: The Jewish Autonomy in the Eighteenth-Century Crown Poland* (History); *After Camp: Portraits in Midcentury Japanese American Life and Politics* (History); *Anna Howard Shaw: The Work of Woman Suffrage* (History); *Mental Health Issues and the University Student* (Psychology); *Nursing Before Nightingale, 1815-1899* (History)

Books with high Twitter mentions concentrate in history, engineering, and biochemistry. Content either addresses daily life (e.g., physiological regulation during exercise), hot topics (e.g., big data and privacy), or historical events and their impacts. These books more easily interest non-specialist readers and resonate widely, leading to mentions and retweets. Thus, social media discusses books across broad disciplines, with timely, inspiring themes more likely to gain user shares.

Books with high Mendeley readership concentrate in engineering, biochemistry, and psychology, showing strong professionalism. These are often disciplinary textbooks or reference works that explain research methods or phenomena accessibly, which users save in personal libraries for future research. Therefore, high Mendeley readership often indicates high pedagogical value.

All books with high online review counts belong to history, covering topics from the American Civil War to pirate economics to climate change impacts. Themes are accessible, interesting, and enlightening, attracting more reader attention. History books have broader reader bases and readability, making online review counts better reflect reading among general audiences.

For holdings, most frequently collected books are in history and psychology. History books cover Jewish autonomy, Japanese American development, and women's suffrage leaders, showing libraries' broad coverage of ethnic cultures and gender equality. Psychology books focus on university mental health; analysis of library types shows university libraries account for about 45% of collections, proving collection patterns relate to library type. Holdings indicators point to classic works or practical books in specific fields, reflecting collection value and fundamental utility.

Across high-indicator books, history dominates, indicating broader reader bases for this discipline. Popular history books often cover European and American history (e.g., French Revolution, American Civil War), possibly because studied books are in English. Psychology appears only in high holdings, suggesting

public awareness needs improvement. Engineering and biochemistry appear only in Twitter and Mendeley indicators, showing their strong specialization and limited general reader attention.

Some scholars suggest highly-mentioned journal papers on Twitter often have sensational titles (e.g., involving rock music, sex, drugs), but this study found title novelty has limited impact on book discussion; content remains the primary focus.

Conclusions and Future Directions

Compared with peer review and citation evaluation, Altmetrics indicators have broader data sources and simultaneously address multiple impact dimensions (academic, social), providing new perspectives for measuring academic book impact. Research based on indicator meanings and data availability selected four Altmetrics indicators: Twitter mentions, Mendeley readership, online review counts, and holdings, covering different impact dimensions. Statistical analysis shows: (1) Low correlation between Altmetrics and citation indicators proves they evaluate impact from different dimensions, supplementing citation limitations; (2) Altmetrics indicators have defects like low coverage and uneven distribution, requiring combination with traditional citation metrics as supplements for comprehensive evaluation.

Empirical analysis of four Altmetrics indicators by publication year, disciplinary differences, and typical book content yields these conclusions: (1) Twitter mentions are highly timely, with recent books more discussed on social media, reflecting real-time social popularity and dissemination breadth; they also reflect non-specialist reading tendencies, with high-indicator books being life-relevant and broadly disciplinary, resonating with diverse readers. (2) As an academic exchange platform, Mendeley shows higher sensitivity to newly published books; readers often save professional textbooks or reference works for future consultation, reflecting pedagogical application value. Applied natural sciences attract more attention than history, possibly related to Mendeley's user demographics. (3) Online review counts reflect popularity among general audiences, representing feedback after deeper reading compared to social media mentions; history books dominate high-review books, showing strong social impact. (4) Holdings have certain lags, as libraries need time to evaluate impact before collection; collected books cover broad foundational fields and disciplinary classics, effectively reflecting collection value.

Overall, Altmetrics can measure academic book impact multidimensionally, but coverage is low and sparse. This study focused on high-indicator typical books, analyzing publication year and disciplinary differences to avoid sparse data issues and summarize indicator characteristics. Future academic book impact evaluation should combine book characteristics (year, discipline) with traditional citation and Altmetrics indicators to explore more comprehensive mechanisms.

This study has limitations. First, Altmetrics data are limited to English books in few disciplines, restricting generalizability. Second, the study focuses on book disciplinary and temporal distribution but lacks discussion of user group differences behind indicators, while user characteristics (type, nationality, discipline) reflect reading motivations, making indicator difference analysis insufficiently deep. Third, holdings analysis lacks in-depth integration with library information.

Future research could explore user group characteristics behind Altmetrics indicators, obtaining specific identity and location data, and analyze user motivations and preferences through Twitter and review text content to identify other factors determining book impact. Beyond publication year and discipline, publisher reputation could be incorporated to improve evaluation mechanisms. For holdings, analysis could be refined by library type and country to clarify reflected impact dimensions; library authority and collection tendencies could also measure collected book impact.

Regarding Altmetrics application to Chinese books, future research could obtain indicator values for Chinese academic books on social media and review sites (e.g., Douban ratings and reviews, Dangdang sales and recommendation data) to explore Altmetrics' effectiveness in revealing and evaluating Chinese book impact and examine differences between Chinese and English book evaluation.

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Author Contributions

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Liu Xiaojuan: Topic selection, writing guidance

Abstract

[**Purpose/significance**] This paper aims to explore the effectiveness of Altmetrics in revealing the impact of academic books, and then put forward reasonable suggestions for academic book evaluation. [**Method/process**] Four Altmetrics indicators, Twitter reference, Mendeley reading, text review and libcitation are collected. After analyzing the coverage, quantiles and other statistics of books, the correlation between book citation and Altmetrics indicators is carried out. Books of high indicator values are evaluated from the aspects of published year, discipline and subject in order to explore the application of these indicators in the use of book impact evaluation. [**Result/conclusion**] The low correlation between book citation and Altmetrics indicators shows that Altmetrics can be used as a new perspective for evaluating academic books, and different Altmetrics indicators reveal different dimensions of book impact. It is suggested to combine Altmetrics indicators and citation and make more use of the characteristics of books such as year and discipline in the future research of book impact evaluation.

Keywords: Altmetrics, Academic Books, Impact Evaluation

Note: Figure translations are in progress. See original paper for figures.