

Altmetrics: a 21st Century Solution to Determining Research Quality

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The number of academic articles published annually has risen exponentially in the past decade, making our jobs as librarians ever more challenging as we assist patrons in finding exactly what it is that they are looking for.

At the same time, traditional measures of research quality such as the journal impact factor and citation counts have been called into question for being unreliable and slow to accumulate. Though these measures have helped librarians filter for quality content in the past, they show weakness when applied to the rapidly evolving scholarly publication marketplace. Neither can be easily applied to non-traditional scholarly outputs such as working papers, technical reports, data sets, or conference presentations.

We have also recently seen a rise in Open Access (OA) publications, which make research easier to access than ever before. Megajournals such as *PLOS ONE* and *Sage Open* publish more articles in a day than some journals do in a year. The sheer volume of available scholarship is enough to make one's head spin.

Given these challenges, how can librarians help patrons access what they seek while at the same time make our own jobs easier as we sift through the ever-rising sands of available scholarship?

Enter altmetrics, a new approach to determining the quality and popularity of research more quickly than ever before. Altmetrics (<http://altmetrics.org/manifesto/>) tally online shares, saves, reviews, adaptations, and social media usage related to research outputs of all kinds—not only traditional publications but also grey literature, digital scholarship, research blogs, datasets, and other modes of scholarly communication. When paired with usage statistics (downloads and pageviews) and traditional measures of impact (journal impact factors and citation counts), they can be an excellent way to help sift through high-quality and popular search results to zero in on what patrons seek.

Following, we will cover the advantages and disadvantages of both new and traditional research metrics with an aim to help you understand how you can use them to filter out the noise in order to better find what you seek.

Journal Impact Factor

The Journal Impact Factor (JIF) was created as a shorthand measure of quality to allow scholars to quickly understand the value of content published in a journal relative to other journals in a particular field. It represents the average number of times that an article published in a particular journal has been cited within the previous two years.

For many years, the JIF was the best, most objective tool available to determine the prestige of a journal. It allowed librarians to understand who the most authoritative publishers were in fields where they might not have domain knowledge. Librarians could also use it to teach the concepts related to information evaluation during instruction sessions to undergraduates. It was often used by junior faculty to understand where to publish in order to advance their careers. The JIF was (and is) a powerful tool when used correctly.

However, since the 1980s many have questioned the supremacy of JIFs as the de facto measure of research quality on two fronts: gaming and granularity. Over the years, reports have surfaced of editorial boards requiring authors to cite articles previously published in their journal in order to inflate the total number of citations received, and thereby increase their JIF. Other critics have pointed out that JIFs are only an approximation of quality, and that true measures of an article's quality should be determined by an article level metric such as a citation count.

Citation Counts

Citation counts are the total number of citations an article receives, usually tracked by a service like ISI Web of Science or Scopus. Generally speaking, the higher the number of citations, the greater the perception of quality for that article. Citations are, after all, the greatest currency that scholars use to acknowledge their intellectual forebears. When filtering through search results on a database, it can be useful to sort results by citation counts to understand which publications are the most highly-regarded on a particular topic.

Such techniques should be used sparingly, however. Articles receive citations for a number of reasons, including vanity (self-citations), politics (honorary citations for a well-respected scholar), and refutation (positing that the original author's hypothesis is incorrect). A salient recent example might be the "arsenic life" article published in the June 2011 issue of *Science*, where nearly all citations received to date have been from scientists disputing the hypothesis of the original article [13].

Another drawback to citation counts is their speed of accumulation. Citations do not accrue as quickly as other measures of impact due to the medium in which they appear. Scholarly articles take on average a year to make it from submission to publication. Considering that citations measure the amount of mentions in others' publications, it can take as long as two years from submission to see the first citations, which some argue is not fast enough given the speed of communication enabled by the Internet. Such turnaround times were acceptable in the days of yore when print journals were the norm, but are no longer appreciated by researchers accustomed to immediate gratification.

Citations also rarely apply to non-traditional forms of scholarly communication like pre-prints, technical reports, conference presentations, posters, and data sets. Though these outputs can be cited, few have associated permanent identifiers such as DOIs that allow for citations to be tracked. These citations are also often not included in databases like ISI Web of Knowledge or the ACM Digital Library.

Finally, using citation counts as a mechanism to filter content can be challenging for librarians without access to subscription databases. It can be much easier to search the Web for a journal's JIF and proxy an article's quality that way, rather than hunting down individual citation counts as they might appear on a publishers' website.

Luckily, studies have shown that instantaneous and freely available measures of quality such as usage statistics and altmetrics can be indicators for the probability of future citation counts.

Usage Statistics

For research metrics, the term "usage statistics" usually refers to pageviews and full-text download counts of content hosted in institutional repositories or on publisher websites. However, the term can also be used to describe search queries, clicks, and requests for access to particular pieces of a larger whole of online content, as well as top referring URLs and time spent on particular webpages.

Studies have shown that pageviews correlate to quality assessments by expert evaluators [6] and that generally speaking, downloads have a strong and consistent correlation with the size of the audience [2]. Still other researchers have found some degree of correlation between PDF downloads and citations [10].

Usage statistics' correlation to traditional impact indicators may not be as important as their ability to show the use of scholarship outside of the bounds of academia, however. Usage statistics, unlike JIFs and citations, can measure an article's use not only by scholars but also by a lay audience. For example, referring URLs for articles published by the scientific journal *PeerJ* show that many readers make their way to the journal via popular news sites like *Slashdot* and *The Economist*. These connections are what make usage statistics—as well as altmetrics—a valuable addition to the suite of impact metrics used to determine what is the most important (and interesting) research being published.

Altmetrics

Though once called a fad, altmetrics have recently gained traction as a supplemental measure of quality for scholarship. A number of studies have shown that scholars are increasingly using the social web to share and discover research; it follows that the ways in which they share, discover, and annotate others' research should be studied to track research impact. A recent article by Priem, Piwowar, and Hemminger (2012) proposes that “citation and altmetrics indicators track related but distinct impacts, with neither able to describe the complete picture of scholarly use alone.” [10] As discussed previously, altmetrics can also show the impact of research outside of the academy. By tracking how scholarship is shared and discussed in real time, the gap between publication and citation can be filled.

What metrics make up altmetrics overall?

Search for an authoritative list of altmetrics measures and you will come up empty-handed. In the rapidly changing online environment, websites and services can gain—and lose—popularity overnight, meaning that there will never be a canonical list of web metrics that comprise altmetrics overall. On the flipside, that means altmetrics are flexible and adaptable to the changing needs of scholars and the public alike, and can tell us a lot about the nature of the research we come upon in the course of our searches.

In Table 1, I have provided a non-exhaustive list of categories and examples of altmetrics measures, accompanied by a description of how the measures are generally used. Generally speaking, there are five types of altmetrics: **shares**, **saves**, **reviews**, **adaptations**, and **social usage statistics**. The web services used to illustrate the various types of altmetrics generally either fall into the categories of **social media** where research is linked to for the purposes of sharing, saving, or reviewing (Twitter, Facebook, Mendeley, Reddit, F1000, etc) or **content platforms** where research outputs are uploaded by their creators (Figshare, Slideshare, Dryad, Github, etc).

Table 1. Types of altmetrics and examples

Altmetric Type	Description	Examples
Shares	Posted publicly in order to share news of research article or outputs	Twitter, Topsy, Facebook, Reddit, news articles, Blog posts, Google+, YouTube, Figshare, Mendeley

Saves	Saved on social bookmarking sites or favorited on social media and social coding websites	Mendeley, CiteULike, Delicious; Github, Twitter, Slideshare
Reviews	Discussed with additional commentary added	Faculty of 1000 (F1000), blog posts, article comments, Facebook comments
Adaptations	Creation of derivative works using an article or other output	Github
Social usage statistics	Downloads or views on web services and social media sites	Figshare, Slideshare, Dryad, Facebook, Youtube

What do altmetrics tell us about research quality?

Generally speaking, the presence of enough of any metrics for a research article can indicate that research is considered “quality.” However, the viral nature of the web can lead to extremes in altmetrics counts, which have led some to make the distinction between two types of research: “scholarly” and “sexy.”

While librarians are familiar with scholarly research, one might wonder what “sexy” research is. Here’s a good example: in October 2009, *PLOS ONE* had the dubious honor of publishing one of the most popular research articles in recent memory, a study on bat fellatio. To date, the piece has garnered more than 250,000 views and 9,000 shares, yet has been cited only 6 times. Sometimes, there is a clear delineation between “sexy” research that is popular with the public and “scholarly” research that is well-respected by other researchers but generally uninteresting to those outside of the academy. More often, the two types of research overlap. Well-respected “scholarly” research can capture the public’s imagination, resulting in popular success.

Sometimes, popularity can indicate future scholarly citations. There have been many studies done to date that point out the correlation between various altmetrics measures and JIFs and citations. (See Table 2.) Some altmetrics measures can tell us in minutes what it takes citations months or years to tell us—the popularity of research amongst other scholars.

Table 2. Altmetrics and their correlations to traditional measures of impact

Metric	Correlation to Traditional Impact
Twitter mentions	Citation counts [4] [12]
Facebook wall posts	Citation counts [12]
Mendeley & CiteULike saves	Citation counts [1] [7] [8]
F1000 Reviews	Citation counts [7]
Expert blog posts	Highly cited papers [11]; Journal Impact Factor [5]
News articles	Citation counts [12]
Wikipedia citations	Citation counts [3] [9]

How can altmetrics be used to improve traditional search habits?

The first and most obvious benefit of altmetrics is the **speed** with which they accumulate. Armed with the knowledge that certain types of altmetrics measures correlate with citation counts, librarians who

are helping patrons find recently published research will be able to confidently recommend certain articles over others, given their altmetrics counts.

Altmetrics also offer something that citation counts cannot: **contextualized metrics**. While rote counts of citations do little to help the end-user understand whether an article is high-quality, altmetrics can offer context through the wonders of text mining. Though still in its infancy, contextualized altmetrics services that support search could become the Next Big Thing, as they can instantly weed out the articles that are being referenced because of their low quality.

For certain fields that tend to rely less on journal articles—communities of practice, in particular—altmetrics can help zero in on the quality of content, **agnostic of format**. It can be difficult to determine the value of scholarship presented in working papers or datasets due to a lack of traditional signifiers of quality. Altmetrics for scholarly content in unconventional formats can help end-users better understand whether that research is worthwhile. Similarly, altmetrics can apply not only to scholarship but to researchers, departments, universities, and even nations to help determine the top experts on any given subject.

What are the limitations to altmetrics?

Altmetrics are not perfect by any stretch of the imagination. As a relatively new type of research metric, there are still some issues that the field will need to address in order for altmetrics to become more widely adopted.

First, altmetrics providers need develop a way to differentiate between scholarly and sexy research. Contextualized altmetrics services are quite new and have not yet been refined. No standards exist for reporting altmetrics; one imagines that a standard will need to be developed to help quickly determine whether a popular piece of scholarship is also high-quality research.

Altmetrics are not currently as user-friendly as the journal impact factor. Critics note that in lacking a single number, rating, or score, altmetrics require scrutiny and interpretation that can be burdensome to end-users.

Other critics point out that the ease with which altmetrics can be tallied is also its biggest weakness, as social media metrics and usage statistics are particularly vulnerable to gaming. Automated download bots can generate thousands of download and pageview requests in minutes. Tweets, Facebook posts, and blog mentions can be easily bought. Though publishers and service providers are working to block gaming attempts, there is not yet a neutral auditing organization such as COUNTER (www.projectcounter.org) that can ensure altmetrics' quality.

Finally, altmetrics do not apply as readily to traditional works such as books or art. When searching for works in these mediums, the option of using altmetrics to supplement search techniques may not apply.

How can I access altmetrics for research?

Altmetrics cannot yet be applied to the search process in a manner similar to citation counts and journal impact factors. Only one search database, Primo (ExLibris), currently offers the option to incorporate altmetrics into search results. However, you can use citation counts and journal impact factors—and

their associated search strategies—as a good starting place, and supplement your approach with altmetrics.

Many publisher websites are now using the services Altmetric.com (Figure 1) and ImpactStory (Figure 2) to document and display the impact of the articles they publish. If a publisher does not offer altmetrics on their website, you can provide the article's DOI to ImpactStory (www.impactstory.org), free of charge, to discover the article's metrics (including downloads and various altmetrics measures).

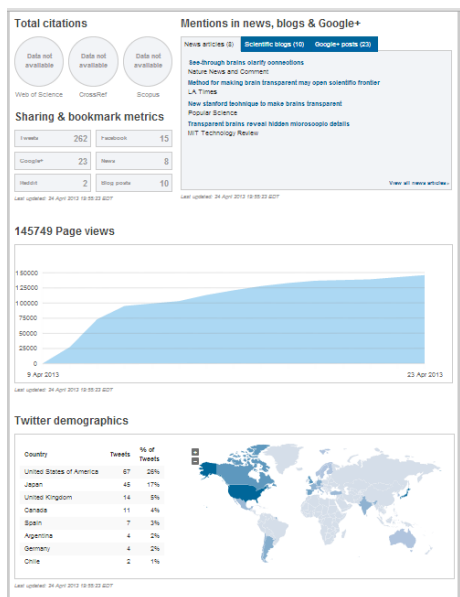


Figure 1. Altmetrics for an article published recently in Nature.

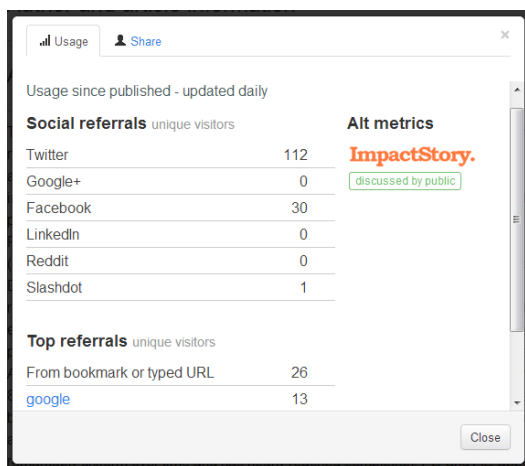


Figure 2. Altmetrics for an article published recently in PeerJ.

As the field continues to mature, it is expected that many databases and publishers will begin to incorporate altmetrics for their search results.

In summary, no research metric is infallible and no single metric can suss out the full value of scholarship. Traditional research metrics, usage statistics, and altmetrics should be used in tandem to identify all dimensions of quality research. Altmetrics are an especially useful instrument, built on web services with which many are familiar, to help patrons make sense of the world of information.

Librarians are working in an exciting time. The glut of readily available information is both a blessing and a curse for the average searcher, which makes our role as information experts invaluable. Altmetrics are just one more tool we can keep handy to filter out the very best research on behalf of patrons.

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