

The Use and Abuse of Citations as Indicators of Research Quality

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Summary

Citation counts have been widely applied as indicators of performance in the evaluation of research. The supposition underlying such applications is that number of citations can be regarded as a measure of scientific quality or impact (Aksnes, 2005); that is, highly cited research can be considered meritorious or significant, since the extent to which research is used (i.e., cited) is a measure of its contribution to knowledge. Indeed, counts of citations, in theory, ought to be more robust measures of research quality than counts of articles, even where these make attempts to distinguish between more and less selective or prestigious journals. This follows the argument that while research may have passed the quality controls of the peer review process (to which no one has proposed a cogent alternative), it is probably even more plausible that merit is intrinsic in the number of citations the research generates, not where it was published. This note briefly reviews the background of this approach and then lists the shortcomings of the approach.

History

Referring to the work of others has been a widely accepted standard of scientific practice since the 19th century. These references are intended to recognize earlier contributions upon which the present contribution was built, and against which it positions itself. Thus, it is a basic feature of the scientific article that it contains a number of such references and that these references are attached to specific points in the text (Research Evaluation and Policy Project, 2005). While the terms ‘reference’ and ‘citation’ are often used interchangeably, there is an important distinction “...if Paper R contains a bibliographic footnote using and describing Paper C, then R contains a *reference* to C, and C has a *citation* from R” (Price, 1970, as cited in Aksnes, 2005, p. 8).

The creation of the *Science Citation Index* (SCI) in 1961 was the catalyst for the emergence of citation analysis as an independent field of study (MacRoberts & MacRoberts, 1988). Since this time, the SCI and similar bibliographic databases (e.g., *Science Citation Expanded*, *Social Sciences Citation Index*, and *Arts & Humanities Citation Index*)—located at the Institute for Scientific Information (ISI) in Philadelphia, Pennsylvania—register all the references (i.e. citations) of indexed publications organized according to the publications they point to. Thus, each publication can be attributed a citation count showing how many times each paper has been cited by later publications indexed in the database (Aksnes, 2005).

Unfortunately, ISI indexes include only a selection of the published literature; primarily journal articles. ISI’s coverage of most disciplines in the natural sciences is relatively good, yet less so for the social sciences and humanities. Even within the natural sciences, there are disciplines such as taxonomy, mathematics, and

earth sciences that are not as well-covered by ISI indexes (Research Evaluation and Policy Project, 2005).

In spite of being covered by the *Arts & Humanities Citation Index*, the creative arts has been a vastly neglected area in the ISI indexes, and what counts as a citable publication is highly debated. For example, publication of a work may entail hearing it, viewing it, reading it, or experiencing it in other ways, such as through performance on a stage or in some other public forum; a narrow view of evaluating publication in the creative arts in written terms alone creates anomalies whereby a painter's paper about their own exhibited painting counts as a publication but the painting does not, and a critical paper on a musical composition counts as publication while a performance of the composition, and even the composition itself, do not count as publication and therefore cannot be cited (Strand, 1998).

Citation analyses¹ are much more difficult to undertake than they outwardly appear and technically more sophisticated than publication analyses. First, formal citation analysis requires access to ISI citation databases. Second, these data must be obtained in a form that allows for manipulation. Neither of these requirements is usually met. Consequently, only a small number of groups exist world-wide which have the capacity to conduct citation analyses that extend beyond a few basic measures (Research Evaluation and Policy Project, 2005). As a 1990 (Boyer) Carnegie Foundation study found, most campuses in the U.S. merely count citations or publications when reviewing their faculty for tenure, promotions, demotions, merit increases, and so forth; sometimes referred to as 'amateur bibliometrics' (van Raan, 2005). Citation rates vary widely across disciplines and

¹ Citation analysis is a branch of bibliometrics which grew out of scientometrics (the science of measuring and analyzing science).

in order to assemble meaningful indicators, citations need to be standardized in order to take this variation into account. As citation rates continue to grow internationally, it also becomes necessary that trend analyses control for these increases in citation rates. Library and information scientists who conduct bibliometric analyses control for these factors by normalizing citation rates by comparing them with international reference values for all publications from the same discipline. Despite the numerous analytic problems (and there are many more than those given above) associated with citation analysis, there are additional practical and technical concerns (c.f., Aksnes, 2005; Glänzel, 2003; MacRoberts & MacRoberts, 1988; Moed, 2003; Research Evaluation and Policy Project, 2005) to conducting valid and reliable citation analyses, such as:

- books are not included in the ISI databases as a source for citations
- authors working in emerging and/or obscure disciplines often receive very high or low numbers of citations (if these are even covered by the ISI databases at all) and these citations may take many years to materialize
- the extent to which, in citing other works, authors have actually read the work they are citing
- corrections for self-citations
- work that is ahead of its time gets few citations (called the ‘Mendel syndrome’)
- ISI databases are dominated by American publications
- language in which a paper is written (English language papers have a higher probability of being cited)

- type of publication (review articles, methods papers, theoretical papers, and papers in ‘fashionable areas’ are cited more often)
- eminent scientists are more often cited than others (the so-called ‘halo effect’)
- incompleteness and high error rates of ISI databases
- limitation on the ‘window’ (i.e., timeframe) in which citation analyses are conducted (often citations do not begin to occur/appear for several years due to publication lag; rates of citation are normally highest 2-3 years following original publication)
- the tendency for authors to preferentially cite other articles in the same journal
- problems with ‘mass producers’, who publish a large number of papers, each receiving few citations by contrast with ‘perfectionists’ who publish little but receive numerous citations to their work
- homonymies (different authors with identical names)
- Journals listed in ISI databases may vary from year to year
- citations do not reflect all influences on a scientific work (e.g., techniques and theories that become assimilated into the existing body of scientific knowledge, the ‘obliteration phenomenon’)
- the arbitrary element in the selection of references (i.e., citations) that authors make

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