2009 Statement
The Culture of Research and Scholarship in Mathematics:
Citation and Impact in Mathematical Publications

A scientist's publication record is the basic ``statistic'' on which promotion, salary and funding decisions are made. In many fields the *number* of citations to a work, the order of authorship, and *impact factor* of the journal, are used as proxies for expert evaluation. For a variety of reasons, mathematicians have not embraced the impact factor as a reliable indicator of a journal's quality. Indeed, there are documented cases where unscrupulous editors have dramatically inflated the impact factors of entirely undistinguished journals; in one case the IF exceeded that of all journals published by SIAM, save for the SIAM Review.[1]

As in many other things, the cultural norms within mathematics are quite different from those in other fields of science. For example, the authors of a mathematical paper are almost always listed alphabetically by surname; all authors are assumed to have made substantive intellectual contributions to the work.

Several issues combine to require careful consideration of publication cultures before understanding and using citation statistics in Mathematics. Mathematics articles tend to be longer, including more detail and exposition (to allow readers to reconstruct arguments with ease), and to be more idiosyncratic in approach (including special examples, and new proofs of known results) than in other disciplines; this requires longer writing times. They also tend to require a longer period to read and digest properly; both refereeing times and first citation times can be an order of magnitude longer.[2]

Citations tend to be focused and targeted to specific required results rather than being used as a broad survey of the field. It is becoming increasingly common for papers on the oft-used, but unrefereed, preprint archive, arXiv.org, to be accepted as citations in published work. Citations of unpublished, but well known, manuscripts have been accepted in mathematical journals for decades, which may also contribute to the lower level of citations to published work. Relative to other fields of science, all of these factors tend to shorten the publication list and citation statistics of senior mathematicians.

These citation practices may contribute to the relatively low impact factors of even the most prestigious mathematical journals, as compared to those in other fields.[3] Other reasons for this disparity are the relatively small size of the mathematical community, that many core mathematical journals are *not* included in the computation of the impact factor,[4] and the fact that 90% of the citations for a mathematical paper occur more than two years after its publication, (and therefore are not counted in the IF).[5]

As in other fields, there is a fairly good consensus within the mathematical community of the relative merits of most major journals; this ranking plays a much larger role in assessing the publication record of an individual than the IFs of the journals. While a mathematician's publication record is considered in determining his/her standing, much greater weight is placed on the substance of the work itself, and its impact *on the subject*, as assessed by experts within the field, than on the number of citations to that work, and the IFs of the journals in which it appears.

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[1] See *Integrity under attack: the state of scholarly publishing*, Douglas N. Arnold, SIAM Review, December 2009.

[2] In 1992, the average time to publication in math journals was 600 days. H.A. Abt, *Publication practices in various sciences*, Scientometrics, Volume 24, Number 3 / July, 1992, DOI 10.1007/BF02051040, Pages: 441-447.

[3] The highest IFs for Math journals are about 2.5, as compared to 15 for Science and Nature, and 35 for New England Journal of Medicine.

[4] *Citation Statistics*, a report of the IMU-ICIAM-IMS, by Robert Adler, John Ewing, and Peter Taylor, June 2008. Available at http://www.ams.org/ewing/Documents/CitationStatistics-FINAL-1.pdf

[5] For example, the two-year 2006 IF of the Annals of Mathematics, arguably the most prestigious journal in the field, is 2.43, while the four-year IF is 4.28, and the 25-year IF is 24.82.