Letter to the Editor

Do We Need the E-index in Addition to the h-index and Its Variants?

Dear Sir,

Today, the h-index is a widely accepted indicator of scientific performance and has become a built-in feature of bibliographic databases such as the Web of Science (Thomson Reuters) and Scopus (Elsevier) (van Eck & Waltman, 2008). The wide acceptance is due mainly to the many advantages of the new index. These include its simplicity and intuitive meaning (Franceschini & Maisano, 2010), the combination of citation impact and publication numbers in one number (British Academy, 2007), and its robustness against small errors and single peaks (top-cited papers) in a publication list (Liu & Rousseau, 2009).

In a recent issue of *Physics Today*, Gott (2010) criticized the h-index for measuring a scientist's output: It does not proportionally reward individuals for their most important papers and unfairly favors scientists in large collaborations. Both critical points are well-known to researchers and have led to some h-index variants that are supposed to not have these disadvantages (Bornmann, Mutz, Hug, & Daniel, in press). For example, the g-index proposed by Egghe (2006) places more weight on the citation performance of a set of papers than does the h-index. Against the backdrop of his critique on the h-index, Gott (2010) proposed "an E-index citation count, proportional to total output. In the E-index, the total count would equal 1/2 first-author citations + 1/2 normalized citations + last-name citations in abstracts + last-name citations in titles" (p. 12). This index was controversially discussed in *Physics Today* by Hirsch (2011), Cardona and Marx (2011), and Rau (2011). This Letter to the Editor is intended to bring this discussion to the awareness of information scientists by formulating further critical points.

The aim of our studies (Bornmann, Mutz, & Daniel, 2008, 2009; Bornmann, Mutz, Daniel, Wallon, & Ledin, 2009; Bornmann et al., in press) on the h-index published so far was to determine empirically the extent to which the development of the h-index variants does in fact result in additional information not provided by the h-index. Although the proposed variants may be conceptualized differently than the h-index theoretically or mathematically, in their empirical application, they may be highly correlated with the h-index. Are there h-index variants that make a nonredundant contribution to the h-index (i.e., that have a low correlation with the h-index)? For Burrell (2009), for instance, each of the h-index variants seems to be approximately proportional to time, and hence each is approximately proportional to each of the others.

The results of the first meta-analysis that has been conducted on the h-index and its variants show, with an overall mean value between .8 and .9, that there is a high correlation between the h-index and 37 h-index variants (Bornmann et al., in press). However, not all h-index variants have a high correlation with the h-index. The characteristics of the h-index variants that correlate less strongly with the h-index could yield information about how best to complement the h-index. For example, if we look at the A-index (Jin, 2006)—it measures the citation intensity in the h-core (i.e., papers with at least h-citations)—we can assume that indicators that focus on the impact of the publications with the highest citation counts within a publication list could yield promising improvements to the original h-index. This is in line with the result of our factor analyses (Bornmann et al., 2008; Bornmann, Mutz, & Daniel et al., 2009), which showed that there are two independent types of h-index variants: those that describe the number of papers in the most productive core, for example, h-index or g-index (output-oriented indexes) and those that depict the impact of the papers in that core, e.g., A-index or m-index (Bornmann et al., 2008) (citation-impact-oriented indexes).

Based on the results of our studies on the h-index and its variants, it probably will be the case that the E-index empirically correlates very highly with one of both index types. Thus, the question is: Do we need the E-index in addition to the h-index and its variants?

References

Bornmann, L., Mutz, R., & Daniel, H.-D. (2008). Are there better indices for evaluation purposes than the h-index? A comparison of nine different variants of the h-index using data from biomedicine. Journal of the American Society for Information Science and Technology, 59(5), 830–837.

Bornmann, L., Mutz, R., & Daniel, H.-D. (2009). Do we need the h-index and its variants in addition to standard bibliometric measures? Journal of the American Society for Information Science and Technology, 60(6), 1286–1289.

Bornmann, L., Mutz, R., Daniel, H.-D., Wallon, G., & Ledin, A. (2009). Are there really two types of h-index variants? A validation study by using molecular life sciences data. Research Evaluation, 18(3), 185–190.

Bornmann, L., Mutz, R., Hug, S.E., & Daniel, H.D. (in press). A meta-analysis of studies reporting correlations between the h-index and 37 different h-index variants. Journal of Informetrics.

British Academy. (2007). Peer review: The challenges for the humanities and social sciences. London, United Kingdom: Author.

Burrell, Q.L. (2009). Some comments on "A Proposal for a Dynamic h-Type Index" by Rousseau and Ye. Journal of the American Society for Information Science and Technology, 60(2), 418–419.

Cardona, M., & Marx, W. (2011). On the value of author indices. Physics Today, 64(3), 9–10.

Egghe, L. (2006). Theory and practise of the g-index. Scientometrics, 69(1), 131–152.

Franceschini, F., & Maisano, D.A. (2010). Analysis of the Hirsch index's operational properties. European Journal of Operational Research, 203(2), 494–504. doi: 10.1016/j.ejor.2009.08.001

Gott, R.J. (2010). A new index for measuring scientists' output. Physics Today, 63(11), 12.

Hirsch, J.E. (2011). On the value of author indices. Physics Today, 64(3), 9.

Jin, B. (2006). H-index: An evaluation indicator proposed by scientist. Science Focus, 1(1), 8–9.

Liu, Y., & Rousseau, R. (2009). Properties of Hirsch-type indices: The case of library classification categories. Scientometrics, 79(2), 235–248.

Rau, R. (2011). On the value of author indices. Physics Today, 64(3), 10.

van Eck, N.J., & Waltman, L. (2008). Generalizing the h- and g-indices. Journal of Informetrics, 2(4), 263–271.

Lutz Bornmann
Max Planck Society,
Hofgartenstr. 8,
80539 Munich (Germany).
E-mail: bornmann@gv.mpg.de

Published online 20 April 2011 in Wiley Online Library (wileyonlinelibrary.com).
DOI: 10.1002/asi.21543