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Research Article

Popularity or Prestige?: The Case of JASIST Rank

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ABSTRACT
In this study, we ranked articles published in the Journal of the American Society for Information Science and Technology (JASIST) between the years 2010–2015, based on their popularity and prestige (quality) with respect to the sources of the citations and their fields and for which each citation has a different weight. We defined the number of citations as reflecting an article's "popularity," and the relative status of the journal in which the article was cited as "prestige." As such, we also took the impact of published works into account in this relevance ranking. We compared our rankings with those in which only the journal impact factor (JIF) is considered. Our findings show that rankings in which prestige value is taken into account are more appropriate for the nature of the articles published in the JASIST.

Keywords: Popularity, prestige, journal impact factor (JIF), eigenfactor (EF), article influence score (AIS).

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INTRODUCTION

Measuring the value of a scientific work is important to researchers, institutions, decision makers, and countries. Researchers consider a number of values with respect to journal quality when considering sources in which they will publish their work. Information professionals also consider these values in the source development process. In addition, the quality of journals in which scientific papers are published is a critical factor in university rankings. Many methods are currently utilized to determine journal values, and they are affected by all these considerations. The *journal impact factor (JIF)* is the most well-known measurement criteria for determining the relative importance of journals. In addition, the *eigenfactor (EF)* is a metric used for evaluating scientific outputs. The JIF is used most both in the collection of sources and in the criteria considered by authors in selecting publication sources for their scientific output. *JIF* is calculated by simply counting the raw number of citations. Another metric for determining the impact of an article within five years of its publication is the article influence score (*AIS),* which is based on its *EF* value (Journal Citation Reports, 2016).

However, these quantitative metrics used in scientific circles to gauge the value of published works do not always yield an accurate evaluation. *JIF* and *AIS* were not initially designed to measure article quality. The original purpose of the *JIF* was to help librarians select journals (San Francisco, 2012). *JIF,* in fact, determines about how many citations "an average article" published in a given journal receives within a specific period of time. Therefore, evaluating the quality of an article by considering only its JIF value is inappropriate. Besides, the distribution of article citations is skewed. A few articles published in journals are cited much more than the average and most others receive few or no citations (long tail theory) (Andersen, 2007). As such, even if the impact factor of a journal is known, the number of citations for an article published in that journal cannot be easily estimated based on the normal distribution theory and the average number of citations. Moreover, the citation culture varies in different disciplines. For instance, the JIF value of a journal in the social sciences is always lower than that of a journal in the physical sciences because books are the dominant form of publication in the social sciences. If we simply consider the number of citations, the citations from each journal are treated equally, and the prestige of the journal from which the citation is made is not considered. In addition, the unique citation culture of the fields is also ignored in these evaluations. In our consideration of popularity and literary prestige, popularity indicates the number of citations made by authors of other studies and prestige indicates which citations were made by more prestigious authors and journals (Ding and Cronin, 2011). Based on these definitions, the popularity of a source cannot be expected to necessarily be equal to its prestige. Therefore, a citation from a more visible study that received many citations does not have the same weight as a citation from a study with lower scientific visibility (number of citations) (Bollen, Rodrigues, and Van de Sompel, 2006; Maslov and Redner, 2008).

In calculating popularity, *JIF* measures how many average citations journal articles received in a given year. This makes it a journal-level metric that normalizes the number of citations (Sjimagojr, 2016). Nevertheless, for this calculation, citations from a journal with a higher impact factor are considered to be equal to those from a journal with a lower impact factor. The problem related to prestige having been ignored in the literature is for the most part solved with the *EF* metric. We can use computer technology to bring to light the connections within a citation structure network. This technique was inspired by Google's *PageRank* algorithm, which offers a more in-depth calculation for the evaluation of sources. Besides the number of citations of publications, *EF* considers the sources of these citations. Thus, we can calculate a more accurate value by taking into account both article popularity and the quality of the citation sources. Furthermore, we perform normalization based on the *EF* calculation fields in which each field has its own distinct citation culture (Bergstrom, West and Wiseman, 2008). To make an article-level evaluation, we obtain the *AIS* value by dividing the *EF* values by the number of articles published in the journal (JCR, 2016). In fact, AIS is similar to the *JIF* metric in being a ratio of the journal citation impact to the number of articles in that journal over a five-year period, (JCR, 2016). Moreover, as *AIS* is calculated based on the whole *JCR* citation network, citation weights differ in citations from journals receiving frequent citations. Therefore, we can use *AIS* as a metric for interdisciplinary comparisons.

Few studies in the literature have separately treated popularity—based on the raw number of citations—and prestige—based on the weighted number of citations. Nor has the difference between popularity and prestige been mentioned in many studies. Only a few researchers have used these two methods to evaluate authors, publications, and journals.

Literature review

The increased weighting of citations from prestigious sources was initially suggested by Kochen (1974) and Pinski and Narin (1976). Pinski and Narin (1976) proposed a model for calculating the prestige of journals by considering the prestige of the journal making the citation. The objective in these studies was to develop a weighted citation-based metric for measuring the relative impacts of scientific journals. According to this metric, citations from a prestigious journal and those from others cannot have equal weight. Later, two methods were proposed for calculating the prestige of scientific products. Bollen, Rodrigues, and Van de Sompel (2006) suggested the use of the *PageRank* algorithm to evaluate the quality (prestige) of products and Berstorm (2007) and Bergstorm, West, and Wiseman (2008) proposed *EF*, as described above.

Before the use of EF value-based studies in the literature, researchers calculated the prestige of journals by using the *PageRank* algorithm, which provided the groundwork for calculating EF. Bollen, Rodrigues, and Van de Sompel (2006) compared journals in terms of their weighted *PageRank* and *JIF* values, and the ranking results yielded very big differences. Only journals such as *Nature, Science,* and *The New England Journal of Medicine* appeared in both rankings. According to that study, while popular journals received high *JIF* values, they had lower *PageRank* values. Habibzadeh and Yadolahie (2008) stated that the best way to measure journal quality is the weighted *JIF* calculation and they conducted a study using the *JIF* values of citation sources. According to this study, if the journal in which the citation was made has a high *JIF* value, a higher value is assigned to the citation. In another study on information retrieval, Ding and Cronin (2011) analyzed how many citations came from highly cited studies.

After the *EF* calculation was introduced, a number of studies compared this metric with others. Davis (2008) found a strong correlation between two metrics in 165 pharmaceutical journals in a comparison of *EF*, total citations, and two-year *JIF* values (Spearman's rho = 0.84). Interestingly, the author also found a strong correlation between *EF* and the total number of citations (Spearman's rho = 0.95). According to this study, popularity and prestige considerations in this field support the same data. Franceschet (2010) took basic bibliometric values into consideration to measure popularity and *EF* values to measure prestige. This author investigated the occurrence of overlapping of five-year *IF* and *EF* values in the social and physical science journals in the *JCR (Journal of Citation Report)*. Accordingly, although there is a strong statistical correlation between prestige and popularity in both fields, there were significant differences in some cases, especially in the physical sciences. Based on the results, the author divided journals into four categories with respect to their prestige and popularity.

We also see higher similarity rates between metrics in studies that have included the *AIS* metric. Arendt (2010) compared *JIF* and *AIS* values and found a significant correlation between them (0.89). The author investigated the variability of the *AIS* metric with respect to discipline. A correlation between the two metrics, however, does not mean that there is necessarily a cause and effect (causality) relationship. Nevertheless, similar findings were made regarding the correlation between these metrics in other comparisons. Saad (2007) compared *EF, AIS,* and *journal h-index* values in journals published between the years 1989–2004, and found a high correlation (0.90) between the metrics. Rousseau and STIMULATE 8 GROUP (2009) also compared *JIF* with four other metrics (*SCImago Journal Rank Indicator (SJR), EF, AIS* and *journal h-index*) in 77 journals on an annual basis. Although each metric had been calculated in a different way and were used in different databases, strong correlations were found between these four metrics and *JIF* metric in the Web of Science (*WoS)* scientific citation index, and also between these four metrics themselves.

Apart from studies of journal and author rankings, a few studies have focused on articles and used the *PageRank* algorithm. Chen, Xie, Maslow, and Redner (2007) examined articles published in the *Physical Review* journal between the years 1863–2003. While the authors found a strong correlation between *PageRank* and total number of citations (0.91), many articles had not been included in the *PageRank* ranking despite the study results showing that they had received many citations. In a study conducted by Ma, Guan, and Zhao (2008) on molecular chemistry and molecular biology articles indexed in the *WoS* between 2000–2005, again, the authors found a strong correlation between *PageRank* and the total number of citations (Spearman's rho = 0.98).

In contrast to the tendency for authors to evaluate prestige and popularity on the basis of journals, in our study we performed an article-level evaluation. Based on the fact that the weight of each citation would differ, we measured the quality of the cited articles by ranking them based on an evaluation of both their popularity and prestige. We evaluated articles published in the *Journal of the American Society for Information Science and Technology (JASIST)* between the years 2010–2015, analyzed the citations of these articles, and calculated their rankings based on their *IF, EF,* and *AIS* values.

Study Objective and Hypothesis

In this study, each citation was recognized as having a different weight, and we sought to answer the question "How much do relevance rankings based on raw citation data (JIF) coincide with those determined by normalizing the EF and AIS fields?" For this purpose, articles of JASIST journal published between the years 2010-2015 were weighted by also considering the value and field of the source which made the citation like in the *PageRank* algorithm. We ranked the articles based on their popularity (*JIF*) and journal-level prestige (*EF*), and then compared these two rankings. Next, we made a list of the *AIS* values obtained from the *EF* values to analyze the article-level prestige values. In these rankings, we assigned a new value to articles that considered the *JIF, AIS,* and *EF* values of the journals which had published the studies citing those articles. Thus, these metrics of the popularity and prestige of the journal were converted to an article–level metric.

Our study hypothesis as follows: "relevance ranking that takes popularity into consideration and makes normalization according to the fields is more successful than relevance ranking based only on the raw number of citations."

Study Scope and Limitations

We examined 1,417 articles published in the *JASIST* journal between the years 2010–2015 and 15,370 (13,965 unique) studies cited by these articles. Since the title of the *Journal of the American Society for Information Science and Technology* was changed to the *Journal of the Association for Information Science and Technology* in 2014, we performed our searches accordingly.

We downloaded and examined all of the articles in the related years and the sources citing these articles in *.txt* and *.xls* formats (no publication type was restricted). To obtain the data to be used in our calculations, we browsed the *WoS* database at the *Information Sciences Institute (ISI)* in the first week of February 2016.

From the *Journal Citation Report (JCR)*, we obtained the *JIF* and *EF* values of the journals, including the sources citing the articles, from *JASIST* issues published between the years 2010–2015. To complete the data set, we also identified the *WoS* website and journal *EFs*, the values of which were not included in the report. Then, we collected their *AIS* values from the eigenfactor.org website. We have not included conferences, proceedings, or books in our data set, which fall outside the scope of the *JIF* and *EF* calculations.

If a citation source of a related article was not indexed on the *WoS,* we referred to it as an external source (Akbulut, 2015), which are not presented in the *WoS*-related records ranking. Therefore, since external source data are outside the scope of this study and we did not include them in our calculations.

Study Method and Data Collection Techniques

We created a data set of all the articles in *JASIST* journal issues published between the years 2010–2015 and the sources of the articles' citations. We listed the cited publications and downloaded them in *.xls* format. After data collection, we cleaned and integrated the data. Since the cited publications manually index some of their information, mistakes are inevitably made in the indexing stage. As such, quantitative studies based on the analysis of incorrect data may be misleading. For instance, a given publication may be recorded as two different publications (see Figure 1). Due care must be exercised in the integration stage to ensure that the big picture is accurately interpreted. In order to improve accuracy, we identified potential duplicate records by running a similarity algorithm (similarity algorithm codes may be found at https://goo.gl/ZktZA2) on the data exported from the *WoS* and on the integrated data (the similarity rate was determined to be 85%).

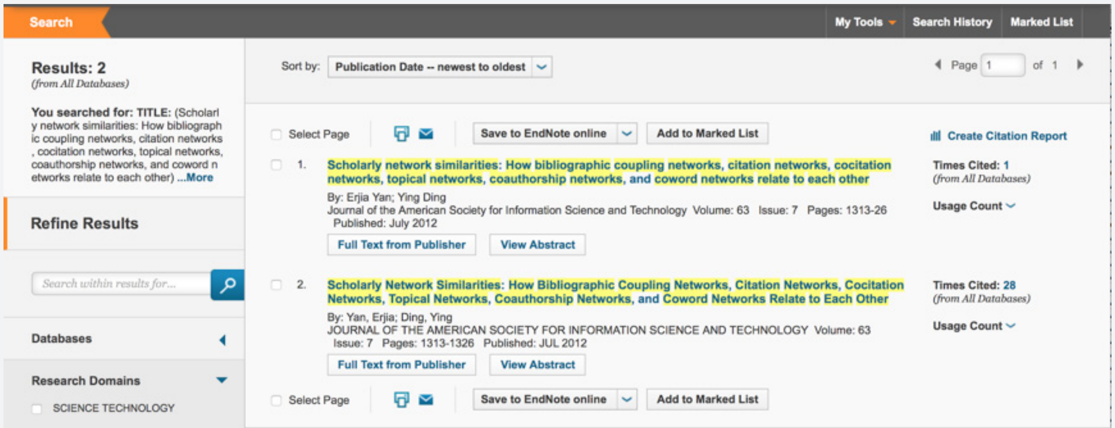

Figure 1: WoS duplicate record example.

Year	Entity	ID	Author(s)	Title	Source
2013	35	1	Liu, Yuntong; Sun, Hua	Word Sense Disambiguation for Chines	MATHEMATICAL PROBLEMS IN ENGINEERING
2013	35	2	Datta, Anwitaman; Yong, Jacks	The Zen of Multidisciplinary Team Rec	JOURNAL OF THE ASSOCIATION FOR INFORMATION SCIENCE AND TECHNOLOGY
2013	35	3	Dornescu, Iustin; Orasan, Cons	Densification: Semantic document ana	NATURAL LANGUAGE ENGINEERING
2013	36	1	Rotolo, Daniele; Leydesdorff, L	Matching Medline/PubMed data with	JOURNAL OF THE ASSOCIATION FOR INFORMATION SCIENCE AND TECHNOLOGY
2013	36	2	Schreiber, Michael	How to improve the outcome of perfo	JOURNAL OF INFORMETRICS
2013	36	3	Torres-Casado, Guillermo; Villa	Scientific impact of articles about the t	REVISTA ESPANOLA DE DOCUMENTACION CIENTIFICA
2013	36	4	Opthof, T.	The impact factor of the Netherlands H	NETHERLANDS HEART JOURNAL
2013	36	5	Keating, Peter; Cambrosio, Alb	Therapy's shadow: a short history of th	FRONTIERS IN PHARMACOLOGY
2013	37	1	Ghasemaghaei, Maryam; Hass	A macro model of online information q	COMPUTERS IN HUMAN BEHAVIOR
2013	37	2	Ghasemaghaei, Maryam; Hass	Online information quality and consum	INFORMATION & MANAGEMENT
2013	37	3	Martens, Betsy Van der Veer	An Illustrated Introduction to the Infos	LIBRARY TRENDS
2013	37	4	Dinneen, Jesse David; Brauner	Practical and Philosophical Considerati	LIBRARY TRENDS
2013	37	5	Ma, Lai	A Sign on a Tree: A Case for "Public Kn	LIBRARY TRENDS

Figure 2: Example representation of the data set of sources that cited articles published in *JASIST*.

We examined the potential duplicate records and consolidated those that were the same.

The downloaded data set included the year, authors, title, and source information. We repeated the same operation for each year and created a single Excel file. In addition to this information, we added "ID" and "Entity ID" domains to this file, as shown in Figure 2. For example, a total of three citations were made for the 35th article (entity id) from the total 1417 articles published in *JASIST* journal between the years 2010–2015 and a total of five citations were made in each of the 36th and 37th articles.

In addition to these domains, we collected the *JIF, EF,* and *AIS* values of the journal in which each study was published in order to calculate the new ranking. As noted above, we obtained the *JIF*[1] and *EF* values from the *JCR*, a product of *Clarivate Analytics*, which is a source for evaluating and comparing scientific journals. For the journals for which these values were not available, we created a list from related values we collected from the *WoS* and *EF* (http://www.eigenfactor.org) websites. We also obtained the *AIS* values from the *EF* website.

For articles published in *JASIS* between the years 2010–2015, we created new values based on the *JIF, AIS,* and *EF* values of the journals that had cited those articles. In other words, we converted the *JIF, AIS* and *EF* values calculated for the journals into article-level values.

To total the *JIF, EF,* and *AIS* values for each source, we removed all duplications from the source domains of the data set shown in Figure 2 and created a new list. Then, we compared this list with a list downloaded from *JCR* (2014) and filled in the missing information using a written script (see Figure 3), thereby obtaining a new list containing *JIF, EF,* and *AIS* values in addition to the domain information (see Figure 3).

1 A journal must have been publishing articles for at least three years in order to calculate its JIF value. We used immediacy index values for the journals having published for less than three years. For this metric, we obtained the journal citations in one year divided by the number of articles published by the journal in the same year. Since time is required for publications to be cited as sources in the journal, their number of citations is low and this value is generally lower than its JIF value.

Year	Entity	ID	Author(s)	Title	Source	JIF	EF Score	AIS
2013	37	1	Ghasemaghaei, Maryam	A macro model of online inforn	COMPUTERS IN HUMAN BEHAVIOR	2,694	0,0183	0,9
2013	37	2	Ghasemaghaei, Maryam	Online information quality and	INFORMATION & MANAGEMENT	1,865	0,0028	0,7
2013	37	3	Martens, Betsy Van der	An Illustrated Introduction to tl	LIBRARY TRENDS	0,386	0,0004	0,1
2013	37	4	Dinneen, Jesse David; B	Practical and Philosophical Con	LIBRARY TRENDS	0,386	0,0004	0,1
2013	37	5	Ma, Lai	A Sign on a Tree: A Case for "Pu	LIBRARY TRENDS	0,386	0,0004	0,1

Figure 3: Example of the data set to which *JIF, EF,* and *AIS* values were added for sources that had cited articles published in *JASIST*.

Year	Entity Name	Mean JIF	Mean EF	Mean AIS
2013	37	1,1434	0,004472	0,38

Figure 4: Representation of the new calculation result.

Year	Entity Name	JIF Rank	EF Rank	AIS Rank
2013	37	668	568	579

Figure 5: Representation of the new ranking result.

We downloaded these sources and their respective values from the *JCR* and, using a second script, added them to the updated list. Thus, we gathered into a single list the information and *JIF, AIS,* and *EF* values of all of the publications that had cited articles in *JASIST issues* published between the years 2010–2015. For example, in Figure 3, there were five citations for article number 37 published in *JASIST* in 2013, and three of these were studies published in *The Library Trends* journal. The other two were in *Computers in Human Behavior* and *Information and Management* journals. The *JIF, EF,* and *AIS* values of these three journals and the number of citations made by each of them must be included in order to perform the new calculation. Therefore, we wrote a third script, in which we multiplied the *JIF, EF* and *AIS* values of the articles citing each entity (for example 37th article published in 2013) by the number of repetitions of that article and took the average to designate a new value for each entity (this value is then used in ranking the related articles). A new calculation was then performed by taking into account the prestige of the sources rather than just their raw citation values, to obtain the new value (Figure 4).

Next, we ranked the cited articles according to their *JIF, EF,* and *AIS* values and compared these lists. For instance, in Figure 3, while article number 37, which was published in *JASIST* in 2013, is ranked 668th in the JIF-based calculation, it is ranked 568th in the calculation that included the fields with the *EF* values. It is ranked 579th in the *AIS* ranking, which is calculated based on the *EF* value.

With respect to the *AIS* values, those lower than 0.1 were treated as 0. Also, since there are many negative values, we took into consideration the absolute value when examining the rankings.

Findings

The *JIF* value is an article-level metric that is the ratio of the number of times an article was cited in one year to the number of articles published in that journal over the previous two years (Web of Science, 2016). While the *JIF* value takes into consideration only the number of citations, the *EF* values are normalized. The *AIS* value is obtained by dividing *EF* by the number of articles published in the journal, and its average value is 1. A journal *AIS* value higher than 1 indicates that the journal has a high average impact and a value lower than 1 indicates that the journal has a low average impact (Cornell University Library, 2016). In this study, we created and compared relevance rankings of the same sources with respect to these metrics. In the first stage, we compared the *JIF* and *EF* rankings and evaluated their similarities. Then, we compared the ranking based on the *EF* values of the citations for articles published in *JASIST* between the years 2010–2015 with the ranking based on the *AIS* values. This comparison served as a kind of study checksum.

Similarities of the Lists and their Rate of Overlap

The *JIF, EF,* and *AIS* rankings comprise the output of the third script in which the values of the articles are calculated. Using this script, we created lists comprising the first 50 records of each ranking based on their *JIF, EF,* and *AIS* values. We considered 50 records from each to be sufficient for detecting similarities and differences between the rankings. As shown in the comparison of *JIF* and *EF* rankings in Table 1, the rate of overlap of these lists is 26% (see https://goo.gl/KjULxC),

Table 1: Articles among the top 50 in both *JIF* and *EF* ranking.

Year	Author(s)	Title	JIF Rank	Eigen Factor Rank
2010	Haque, Asif-ul; Ginsparg, Paul	Last but not Least: Additional Positional Effects on Citation and Readership in arXiv	1	11
2013	Mulligan, Adrian; Hall, Louise; Raphael, Ellen	Peer review in a changing world: An international study measuring the attitudes of researchers	2	37
2010	Marcial, Laura Haak; Hemminger, Bradley M.	Scientific Data Repositories on the Web: An Initial Survey	8	31
2015	Costas, Rodrigo; Zahedi, Zohreh; Wouters, Paul	Do "altmetrics" correlate with citations? Extensive comparison of altmetric indicators with citations from a multidisciplinary perspective	11	4
2012	Rotman, D; Procita, K; Hansen, D; Parr, CS; Preece, J	Supporting content curation communities: The case of the Encyclopedia of Life	12	18
2010	Stringer, Michael J.; Sales-Pardo, Marta; Amaral, Luis A. Nunes	Statistical Validation of a Global Model for the Distribution of the Ultimate Number of Citations Accrued by Papers Published in a Scientific Journal	14	14
2012	Cui, Hong	CharaParser for Fine-Grained Semantic Annotation of Organism Morphological Descriptions	17	24
2012	van Dalen, Hendrik P.; Henkens, Kene	Intended and Unintended Consequences of a Publish-or-Perish Culture: A Worldwide Survey	21	17
2014	Wan, Xiaojun; Liu, Fang	WL-Index: Leveraging Citation Mention Number to Quantify an Individual's Scientific Impact	22	1
2012	Yan, Erjia; Ding, Ying	Scholarly network similarities: How bibliographic coupling networks, citation networks, cocitation networks, topical networks, coauthorship networks, and coword networks relate to each other.	23	2
2011	Suakkaphong, Nichalin; Zhang, Zhu; Chen, Hsinchun	Disease Named Entity Recognition Using Semisupervised Learning and Conditional Random Fields	24	3
2013	Bertoli-Barsotti, Lucio	Improving a decomposition of the h-index	44	8
2014	Boyack, Kevin W.; Klavans, Richard	Creation of a Highly Detailed, Dynamic, Global Model and Map of Science	50	16

which means that the number of articles that are on both lists is 13.[2] Table 1 presents information about the 13 records on both lists. When carefully examined, we can see that the top-ranked records are among the top 50 on the other list. For example, whereas the study titled "Last but not Least: Additional Positional Effects on Citation and Readership in arXiv" published in *JASIST* in 2010 is ranked first in *JIF* ranking, it is ranked 11th in *EF* ranking. The reason why the JIF-based ranking was so high for this article which had received only three citations was that the citations were made by sources from which many other citations are made, such as from *Nature,* from *JASIST,* and from an *ISSI (International Society for Scientometrics and Informetrics)* proceedings book. The *EF* value dominated the ranking slightly more since it does not include self-citation. Yet, when the status of the journal in which the article was published was considered, just two citations propelled this article to 11th-place ranking since both citations were from articles in a prestigious journal.

Comparison of JIF and EF rankings

When we examine the rankings created by taking *JIF* and *EF* values into consideration, the problematic aspects of the *JIF* metric become evident. Outliers, especially for articles with a low number of citations, yield misleading results. We examined all records (1417 records) on a yearly basis in order to determine the difference between the two rankings. Specifically, we looked at the values for which there was the biggest difference between the *JIF* and *EF* rankings. To do so, since studies with a low number of citations do not yield precise results and since making generalizations would lead to inaccuracies, we considered only those values with a high number of citations in a year.

Figure 6 shows studies with the highest *EF* and the lowest *JIF* annual values and those with the highest *JIF* and lowest *EF* annual values. When we examine the ranking values, the

2 We note that as the total number of articles is as high as 1417, the possibility of a high similarity rate is low.

Year	Author(s)	Title	Times Cited	Mean JIF	Mean EF Score	Times Cited	JIF Rank	EF Rank	Variation
2010	Thelwall, M; Buckley, K; Paltoglou, G; Cai, D and Kappas, A.	Sentiment in Short Strength Detection Informal Text	145	1,8	0,1	143	405	77	328
2010	Rafols, I; Porter, A. L. and Leydesdorff, L.	Science Overlay Maps: A New Tool for Research Policy and Library Management	89	2,4	0,04	90	99	110	-11
2011	Thelwall, M; Buckley, K and Paltoglou, G.	Sentiment in Twitter Events	104	1,7	0,1	104	429	78	351
2011	D'Angelo, C.A.; Giuffrida, C. and Abramo, G.	A Heuristic Approach to Author Name Disambiguation in Bibliometrics Databases for Large-Scale Research Assessments	62	2	0,005	62	244	501	-257
2012	Thelwall, M; Buckley, K. And Paltoglou, G.	Sentiment Strength Detection for the Social Web	74	1,8	0,04	74	400	111	289
2012	Waltman, L.; Calero-Medina, C; Kosten, J; et al.	The Leiden ranking 2011/2012: Data collection, indicators, and interpretation	73	2,6	0,1	73	53	74	-21
2013	Waltman, L. And Schreiber, M.	On the calculation of percentile-based bibliometric indicators	20	2	0,08	19	238	91	147
2013	Bornmann, L.	What is societal impact of research and how can it be assessed? a literature survey	26	2,6	0,08	26	61	93	-32
2014	Haustein, S.; Peters, I.; Sugimoto, C.R.; Thelwall, M. and Lariviere, V.	Tweeting Biomedicine: An Analysis of Tweets and Citations in the Biomedical Literature	30	2	0,14	31	232	65	167
2014	Mohammadi, E. and Thelwall, M.	Evaluation and Knowledge Flows	19	1,3	0,003	19	607	625	-18
2015	Thelwall, M. and Kousha, K.	ResearchGate: Disseminating, Communicating, and Measuring Scholarship?	4	1,2	0,006	4	624	436	188
2015	Xia, J.; Harmon, J.L.; Connolly, K.G.; et al.	Who publishes in "predatory" journals?	8	7	0,04	8	3	113	-110

Figure 6: Studies with the highest *EF* and the lowest *JIF* annual values and studies with the highest *JIF* and lowest *EF* annual values.

negative values at the top of the variation column indicate that the article is top-ranked, based on the raw-citation calculation, and it is low-ranked when they have EF and AIS field-normalized values. When we examine the citations for these studies, there is a higher possibility of the *sleeping beauty* or *citation classics* effect. The positive values, in contrast, are the top-ranked sources with calculations based on normalized values, but are low-ranked when based on pure citation values, for which the possibility of the *sleeping beauty* or *citation classics* effect is lower. This effect is dominated in the new ranking.

For example, the variation values for the study titled "Sentiment in Short Strength Detection Informal Text" in the first ranking is 328. In other words, it is top-ranked in the ranking that is citation-field-normalized, but is bottom-ranked in the raw-citation-based ranking. The second-ranked study titled "Science Overlay Maps: A New Tool for Research Policy and Library Management" has a variation value of −11 and is top-ranked in the raw-citation-based ranking, but is bottom-ranked in the citation-field-normalized ranking. Therefore, the sources indirectly impacted by the *sleeping beauty* or *citation classics effect* are moderated, and as such, they are not top-ranked as are raw-citation-based (*JIF*) articles.

The differences in the rankings may be due to the phenomenon in which the citation distortion is intensified, which is referred to in the literature as *the Matthew effect*. The Matthew effect, which indicates an accumulated advantage, is used in sociology for situations in which the rich get richer and the poor get poorer. In bibliometrics, the *Matthew effect* refers to the phenomenon whereby if two scientists have conducted studies of a similar nature, the well-known one will receive more citations than the lesser known scientist (Merton, 1968, 1988, Smucker, 2008). When we consider the citation tendencies of authors, the fact that an article has received many citations is usually an indication that it will continue to receive many future citations. As is frequently seen in the literature, some studies receive many citations due to their historical significance even if they are not directly related to the study in which the citation is made. This may lead to problems in citation-based measurements (Wang, 2014). In a calculation such as that for *EF,* where citation-field normalization is performed, *the Matthew effect* is moderated. Thus, these types of articles can be prevented from being ranked higher than they deserve

The *sleeping beauty* or *citation classics* effect, which is caused by the *Matthew effect,* is presented in Table 2. Since our data set comprises publications which are a maximum of five years old and which have received a maximum of 157 citations, the possibility of their having been affected by the *sleeping beauty* or *citation classics* effect is very low. In any case, Figure 6 shows the potential for the *sleeping beauty* or *citation classics* effect.

Comparison of JIF and EF Rankings

After comparing the rankings based on the *JIF* and *EF* values, we compared the rankings based on the *EF* values with those based on *AIS* values. Our objective was to crosscheck our results by comparing *EF* values, in which the status of the journals in which the articles are published are taken into consideration, with the *AIS* values also obtained from this metric.

Our comparison of the first 50 *EF* and *AIS* records showed that the rate of overlap of these two lists is 22%. The top-ranked studies of both lists are also among the top 50 of the other list. In addition, the top four studies in the *EF* ranking are also among the top 50 in the *AIS* ranking.

When we examine these three lists together, we see that all of the studies that ranked in the top 50 in both the *EF* and *AIS* rankings (11 studies) are also among the top 50 in the *JIF* ranking. The *EF–AIS* comparison demonstrates less similarity than does the comparison of the *JIF–EF* rankings.

Figure 7 shows a Venn diagram of the *JIF, AIS,* and *EF* metrics, which we examined in detail. We plotted the diagram for the top 50 records of the rankings based on all three metrics. As we can also see here, the intersection of the *JIF–EF* ranking list (26%) is bigger than that of the *AIS* and *EF* (22%) for the top 50 records in each category.

As already noted, *AIS* measures the average impact of an article in a journal within the five years of its initial publication, we obtain its value by dividing the number of articles in the

Table 2: Citation distribution of studies with the highest number of citations each year.

Title	Authors	2010	2011	2012	2013	2014	2015	2016
Sentiment in Short Strength Detection Informal Text	Thelwall, Mike; Buckley, Kevan; Paltoglou, Georgios; Cai, Di; Kappas, Arvid	0	6	16	26	46	48	15
Sentiment in Twitter Events	Thelwall, Mike; Buckley, Kevan; Paltoglou, Georgios	0	2	14	26	33	29	4
Science Overlay Maps: A New Tool for Research Policy and Library Management	Rafols, Ismael; Porter, Alan L.; Leydesdorff, Loet	0	9	20	24	17	21	3
Sentiment Strength Detection for the Social Web	Thelwall, Mike; Buckley, Kevan; Paltoglou, Georgios	0	0	4	15	23	32	8
The Leiden ranking 2011/2012: Data collection, indicators, and interpretation	Waltman, Ludo; Calero-Medina, Clara; Kosten, Joost; Noyons, Ed C. M.; Tijssen, Robert J. W.; van Eck, Nees Jan; van Leeuwen, Thed N.; van Raan, Anthony F. J.; Visser, Martijn S.; Wouters, Paul	0	0	0	19	27	28	4
A Heuristic Approach to Author Name Disambiguation in Bibliometrics Databases for Large-Scale Research Assessments	D'Angelo, Ciriaco Andrea; Giuffrida, Cristiano; Abramo, Giovanni	0	7	9	17	14	15	1
Tweeting Biomedicine: An Analysis of Tweets and Citations in the Biomedical Literature	Haustein, Stefanie; Peters, Isabella; Sugimoto, Cassidy R.; Thelwall, Mike; Lariviere, Vincent	0	0	0	0	7	22	5
What is societal impact of research and how can it be assessed? a literature survey	Bornmann, Lutz	0	0	0	3	8	16	0
On the calculation of percentile-based bibliometric indicators	Waltman, Ludo; Schreiber, Michael	0	0	0	5	6	9	2
Mendeley Readership Altmetrics for the Social Sciences and Humanities: Research Evaluation and Knowledge Flows	Mohammadi, Ehsan; Thelwall, Mike	0	0	0	0	5	13	3
Who publishes in predatory journals?	Xia, Jingfeng; Harmon, Jennifer L.; Connolly, Kevin G.; Donnelly, Ryan M.; Anderson, Mary R.; Howard, Heather A.	0	0	0	0	0	7	0
ResearchGate: Disseminating, Communicating, and Measuring Scholarship?	Thelwall, Mike; Kousha, Kayvan	0	0	0	0	0	4	1

journal by the *EF* values of the journal. This measurement is approximately similar to the five-year *JIF* calculation (Web of Science, 2012). In other words, *AIS* is the contribution of the number of articles in the journal over a period of five years. Therefore, it is not surprising to see that the list based on the *JIF* and *EF* values is similar to the list based on *EF* and *AIS* values.

The scatter plots of the *EF, AIS,* and *JIF* values for the whole data set (Figures 8 and 9) offers clues about the similarity of the metrics.

Since our data set contains outliers and it is not normally distributed, it is difficult to identify similarities in the scatter plots based on raw values. We performed a logarithmic transformation to more easily observe the similarity rate and to see outliers as a little closer to each other. To facilitate interpretation, we also used the respective absolute values for the negative values in the data set to ensure that the x and y axes of the compared graphics comprised the same values.

The points representing articles in Figure 8 are more scattered than those in Figure 9. This means that the *JIF* and *EF* values are closer to each other than are the *EF* and A*IS* values in the whole data set, as is the case in the sample in which we examined the top 50 records.

Conclusion and Recommendations

Based on the idea that the weight of each citation differs, in our study we considered the weighted number of citations rather than the raw number of citations. The potential for journal citations in some scientific fields are higher than in others. For instance, the potential for a journal publishing in the basic science field to receive citations is higher than one that publishes in the field of clinical sciences. In this case, evaluating the quality or distinction of a journal based only on the number of citations per paper can be misleading. Since citation-field normalization is performed in *EF* calculations, this misleading effect is reduced. We weighted the scores of journals calculated with this method by their association with each citation. In other words, we determined the weight of a

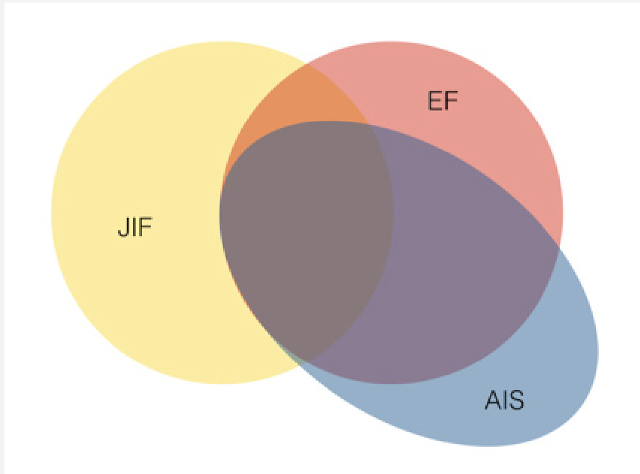

Figure 7: **Venn diagram for *JIF*, *EF,* and *AIS* values.**

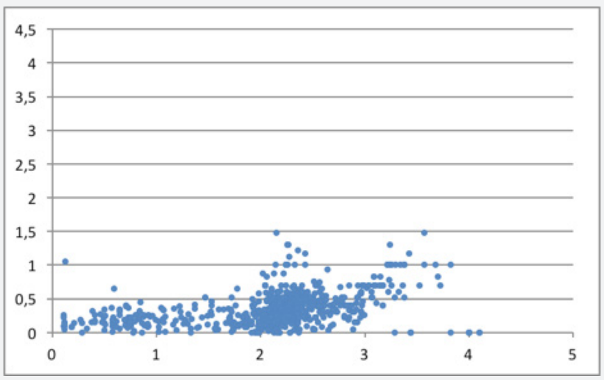

Figure 8: **Distribution (logarithmic) of *EF* and *AIS* absolute values.**

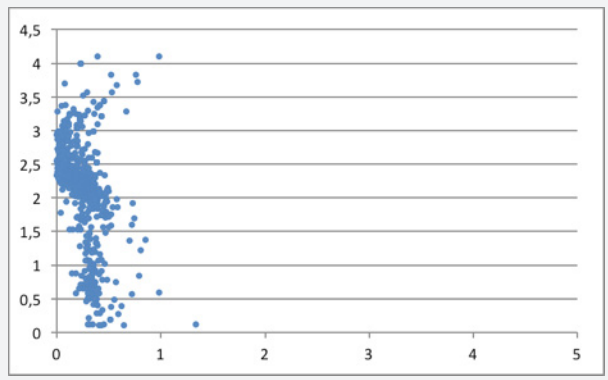

Figure 9: **Distribution (logarithmic) of *JIF* and *EF* values.**

citation by an article-level calculation of *EF,* which is based on a journal-level calculation method inspired by the *PageRank* algorithm. Then, we crosschecked the results by comparing the *AIS* metric based on the *EF* value. Due to the interdisciplinary nature of information sciences, the ranking changed significantly upon normalization, yet the minimum overlap rate is 22% for rankings of the top 50 records.

We did not confirm our hypothesis that "relevance ranking that takes popularity into consideration and normalizes the citation fields is more successful than relevance rankings based on the raw number of citations." This is because even though we normalized the *EF* and the EF-based *AIS* metrics, the calculation results for the *AIS* metric are basically similar to the five-year *JIF* value (Web of Science, 2016). Our findings showed that rankings based on *JIF* and *EF* values are even more similar.

The data set used in our study is limited to the sources indexed in the *WoS*, and it is possible that sources from journals not indexed in the *WoS* may change the ranking. However, this effect would likely be very slight. It is obvious that journals that do not meet the criteria for being indexed in the *WoS* would not have much impact on prestige calculation either.

Further Study

Our findings show that the ranking created with *EF* values inspired by the *PageRank* algorithm is more appropriate for articles published in issues of the JASIST journal (since the mentioned articles are interdisciplinary). We found that sources having *the Matthew effect, citation classics,* and *sleeping beauty* properties are moderated in the *EF* ranking. The ranking of *EF* calculation at the article level represented reality more accurately. In other words, it is a much more appropriate metric for this field. On the other hand, the exclusion of all self-citations by journals in the calculations of the *EF* score may also cause misleading results. In future work, these two rankings should be compared by including journal self-citations in the calculations. Since there will be more citations if older publications are considered in studies, we anticipate the possibility that they would more accurately represent the citation universe.

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