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Discussion and Recommendation in Social Scientific Spaces: Two Factors Correlated with the Impact factor of Scientific Publications

Saeideh Ebrahimi
Assistant Prof. Knowledge and Information Science , Department of Knowledge and Information Science, College of Education and Psychology, Shiraz University, Iran, Corresponding Author, Email: sebrahimi.shirazu@gmail.com

Fatemeh Setareh
M.A. in Knowledge and Information Science, Department of Knowledge and Information Science, College of Education and Psychology, Shiraz University, Iran, Email: rahian1370@gmail.com

Abstract

A review on previous literature shows that there is a correlation between discussion and recommendation. Therefore, we aimed to assess the relationship between these two metrics in four systems (Scopus, Web of Science, PubMed Central, and CrossRef) simultaneously and separately. This was a descriptive correlational study on 90728 research articles published in seven biomedical journals in the PLOS system during 2009-2013. The sample size was calculated based on the Cochrane formula to be 1892 articles. For data collection, PLOS system was used which enables free access to the articles of important biomedical journals. This system includes 7 journals cited from 2003. Data were analyzed using SPSS software, version 21. In this study, we found a negative and statistically significant correlation between discussion on Twitter and the citation-based systems. We found no correlation between discussion on Facebook and citation. On the other hand, we found a positive and statistically significant correlation between recommendation by F1000 and citation. We found that discussion on virtual networks and recommendation are two types of feedback in virtual environments. However, among the various systems, the F1000 and Wikipedia were able to provide significant feedback leading to citation.

Keywords: Discussion, Twitter, Facebook, Wikipedia, recommendation, F1000, citation index, Scopus, Web of Science, PubMed Central, Crossref, PLOS system, alternative measures.

Introduction

Citation indices have been used for many years to assess the effect of articles in scientific societies. Despite its importance and validity, this measurement has some limitations that led to the emergence of other novel measurement methods in scientometrics (Bornmann and Haunschild, 2015). For example, citation only measures the effect of scientific publications, especially research articles and journals based on time (Sud and Thelwall, 2014) and the data collection tool (Torres-Salinas, Cabezas-Clavijo and Jiménez-Contreras, 2013).

With the emergence and development of virtual scientific communities and communications, various indices have been introduced. Bookmarking, citing articles in weblogs or wikis, and discussing and recommending articles in virtual spaces are among such indices. These metrics, known as altmetrics, were first introduces by Twitter (Piwowar, 2013) and are considered as a new subject field in information sciences (Liu and Euan Adie, 2013). With the development of new scientific evaluation methods, these metrics are used for evaluating scientific activity to complete citation-based methods (Konkiel and Scherer, 2013). These metrics can rapidly trace the survival of any article after publication. Therefore, a shift from journal level metrics to article level metrics is necessary (Scardilli, 2014). Despite being novel, research in the field of altmetrics is rapidly expanding. Researchers believe that these metrics are based on social media data that can provide vast amount of feedback with respect to new scientific findings (Weller, 2015).

Various web-based tools such as Twitter, Facebook, Wikipedia, or F1000 can present these indices. Twitter is a popular social network. It was developed in 2006 to rapidly tweet information to web users (Kumar Das and Mishra, 2014). It has three unique features: possibility to send tweets and to edit them, sending messages to other Twitter users, and use of hashtags (Holmberg and Thelwall, 2014). Facebook also enables people to present their information on a virtual platform and peer groups can see each other’s profiles and send each other messages. Facebook members can join virtual groups based on mutual interests (Ellison, Steinfield and Lampe, 2007).

Wikis are another set of systems that influence the rating of altmerics. A wiki is a page or collection of pages that gives individuals access to share content. Many experts use wikis as edicational tools and students can share their opinions in that wiki or edit shared information (Click and Petit, 2010). Altmetrics are also presented in tools such as F1000. F1000 is an accurate post-publication evaluation system whose experts rate and evaluate biomedical publications (Mohammadi and Thelwal, 2013). F1000 evaluators bookmark each article based on the interests of different user groups (Bornmann and Haunschild, 2015). Altmetrics evaluations are not only used for journals, but also for books, conference articles, lectures, videos, program codes, and other forms of scientific information (Mazov and Gureev, 2015). With the help of these metrics authors are able to see the statistics of those who have read their articles. On the other hand, these metrics are important in developing resources (Konkiel and Scherer, 2013).

Altmetrics have other capabilities as well. In contrast to traditional citation-based metrics, altmetrics measure social influence and can evaluate article level indices (Torres-Salinas, Cabezas-Clavijo and Jiménez-Contreras, 2013). Use of these metrics besides other traditional citation-based metrics are important for attaining various metrics (Konkiel, 2013). With the emergence of new metrics and their use in research evaluation, various studies have been done in this regard. The aim of these studies was to evaluate whether evaluations based on altmetrics are in line with citation-based ones. Most studies have indicated a positive correlation between these two.

Discussion and Recommendation are two types of altmetric attentions assessed in previous studies. In a study on 55 articles indexed in Journal of Medical Internet Research done during 2009-2010, a statiatically significant relationship was found between the number of tweets and number of citations. Moreover, the relationship between Google Scholar citations and number of tweets on Twitter was better than Scopus citations (Eysenbach, 2011). Other researchers found a relationship between the tweets of arXiv publications and

Google Scholar citations and their downloads by assessing 4606 scientific articles sent to arXiv during 2010-2011 (Shuai, Pepe and Bollen, 2012).

Thelwal and colleagues (2013) found a positive significant relationship between altmetrics data and number of citation when assessing 1.4 million articles cited in PubMed and Web of Science during 2010-2012. Costas, Zahedi and Wouters (2014) assessed 1380143 records from the altmetrics website and found a weak positive correlation between altmetrics and Web of Science citations. In general Twitter and weblog citations had the highest relationship with citation.

Other studies have focused on the relationship between recommendation and citation. In one study on 1530 articles from seven important bioenvironmental journals in 2005, the researchers found that the citation mean and frequency of 103 eminent publications of F1000 was high but not significant (Wardle, 2010). In this regard, Mohammadi and Thelwall (2013) assessed about 900 medical articles during 2007-2008 and evaluated the relationship between Scopus citations and the factor of F1000 articles. They found that only the relationship with novel achievements, new findings and changes in clinical practice differed significantly among the articles. In a study on 125 articles in the field of biology and immunology during 2008, the researchers found a significant relationship between citation and altmetrics in Web of Science and F1000 (Bornmann and Leydesdorff, 2013). A study on 18427 articles in weblogs and their future citations during 2009-2010 showed that recommended articles in research blogs attracted more citation in the Web of Science (Shema, Bar-Ilan and Thelwall, 2014).

A review on previous literature shows that there is a correlation between discussion and recommendation. Therefore, we aimed to assess the relationship between these two metrics in four systems (Scopus, Web of Science, PubMed Central, and CrossRef) simultaneously and separately.

Materials and Methods

This was a descriptive correlational study on 90728 research articles published in seven biomedical journals in the PLOS system (fig 1 & 2), during 2009-2013. Sampling was done using stratified and systematic random sampling. The sample size was calculated based on the Cochrane formula to be 1892 articles.

We chose the 2009-2013 timeframe because the journals indexed in the PLOS altmetrics system each present different time periods and the commonly shared point for beginning their activities was 2009. Therefore, the starting point for our evaluation was set as 2009. On the other hand, for evaluating citation metrics a minimum time span is needed for receiving citations. Moreover, citations of articles in the PLOS altmetrics system are presented with a one-year time lag, and at the time of this study, the citations of the articles during 2014 were not presented. Accordingly, the best study period was determined to be 2009-2013.

For data collection, PLOS system was used which enables free access to the articles of important biomedical journals. This system includes 7 journals cited from 2003. Data were analyzed using SPSS software, version 21. Descriptive and inferential statistics were used as appropriated. We found that the data had similar distribution. Therefore, we used Spearman’s non-parametric test for analysis.

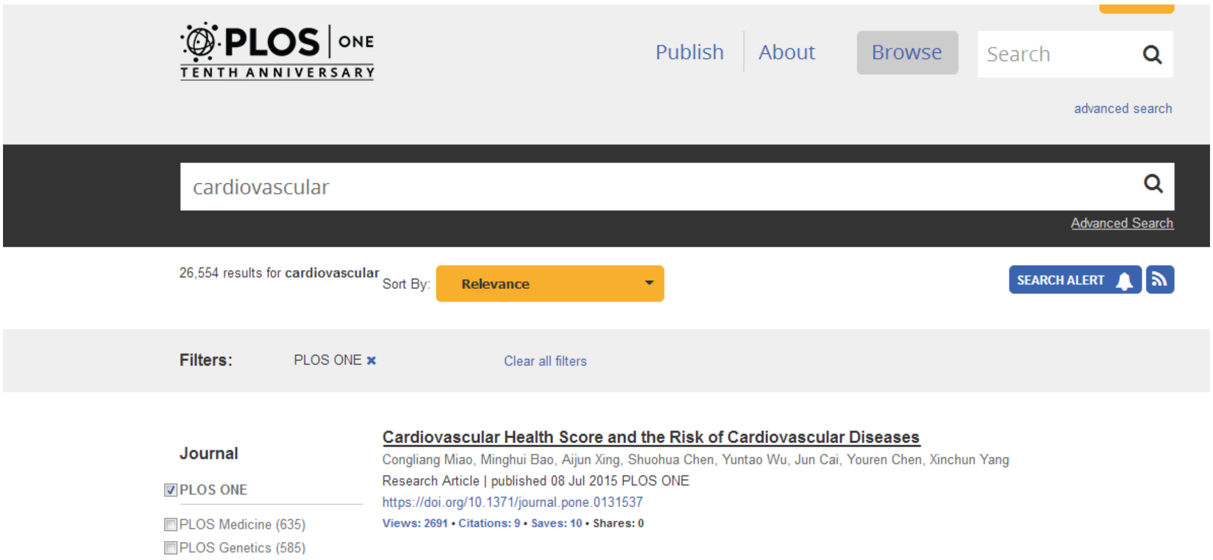

Figure 1. PLOSE System. Source: http://journals.plos.org

Figure 2. PLOSE System. Source: http://journals.plos.org

Results

The minimum frequency of the metrics was similar in all articles (table 1). On the other hand, the metrics related to discussion on Facebook had the highest frequency and recommendation in F1000 had the lowest frequency (table 1). Therefore, users tended to share their articles on Facebook.

Table 1

Descriptive results related to discussion, recommendation, and citation of articles in the PLOS system

Variables	Mean	Minimum	Maximum
Discussion on Twitter	2.15	0	113
Discussion on Facebook	6.22	0	270
Discussion on Wikipedia	0.29	0	21
Recommendation by F1000	0.15	0	6
Citation in PubMed Central	12.56	0	182
Citation in Web of Science	20.22	0	226
Citation in Scopus	21.3	0	251
Citation in CrossRef	15.22	0	199

We found that the data had similar distribution. Therefore, we used Spearman's non-parametric test for analysis. The results showed a negative statistically significant correlation between discussion on Twitter and citation-based systems (r=-0.2, P≤0.001). However, this correlation was weak and therefore, users who shared their articles on Twitter received relatively less citations.

Table 2

Results of Spearman's correlation test regarding discussion on Twitter and Citation in PLOS

variables		r	sig
Discussion on Twitter	Citation in PubMed Central	**-0.192	0.001
	Citation in Web of Science	**-0.172	0.001
	Citation in Scopus	**-0.146	0.001
	Citation in CrossRef	**-0.113	0.001

**Significance at the 0.01 level

We also found no correlation between discussion on Facebook and citation. Therefore, the articles discussed on Facebook does not affect their citation.

Table 3

Results of Spearman's correlation test regarding discussion on Facebook and Citation in PLOS

variables		r	sig
Discussion on Facebook	Citation in PubMed Central	-0.026	0.268
	Citation in Web of Science	-0.003	0.91
	Citation in Scopus	0.016	0.481
	Citation in CrossRef	0.029	0.214

As shown in table 4, we found a positive and significant correlation between discussion on Wikipedia and citation (r=0.2, P≤0.001). Therefore, articles discussed on Wikipedia received more citation.

Table 4
Results of Spearman's correlation test regarding discussion on Wikipedia and Citation in PLOS

variables		r	sig
Discussion on Wikipedia	Citation in PubMed Central	**0.196	0.001
	Citation in Web of Science	**0.211	0.001
	Citation in Scopus	**0.195	0.001
	Citation in CrossRef	**0.211	0.001

** Significance at the 0.01 level

As shown in table 5, we found a positive and significant correlation between recommendation in the F1000 system and citation (r=0.2, P≤0.001). Therefore, if an article is recommended by the F1000 experts it would probably receive more citations in the future.

Table 5
Results of Spearman's correlation test regarding recommendation by F1000 and Citation in PLOS

variables		r	sig
Recommendation by F1000	Citation in PubMed Central	**0.208	0.001
	Citation in Web of Science	**0.224	0.001
	Citation in Scopus	**0.199	0.001
	Citation in CrossRef	**0.211	0.001

** Significance at the 0.01 level

Based on the obtained results, it can be inferred that there is a weak relationship between recommendation by F1000 and discussion on Facebook and Wikipedia; and there is no correlation between recommendation and discussion on Twitter. Therefore, with an increase in discussion on Facebook and Wikipedia, the amount of recommendation increases (table 6).

Table 6
Results of Spearman's correlation test regarding recommendation by F1000 and Discussion in PLOS

variables		r	sig
Recommendation by F1000	Discussion on Twitter	0.04	0.082
	Discussion on Facebook	**0.084	0.001
	Discussion of Wikipedia	**0.069	0.003

**Significant correlation at the level of 0.01

Discussion

In this study, we found a negative and statistically significant correlation between discussion on Twitter and the citation-based systems. Our results are inconsistent with those obtained by Eysenbach (2012), who found that 75% of highly tweeted articles received more citation and this did not apply to only 7% of the articles. Therefore, he concluded that tweets are able to predict citations during the first three days after publication. Eysenbach stated that this relationship is more correct for Google Scholar citations because Google Scholar encompasses a wide range of citation sources, especially non-journal sources. Another issue raised by Eysenbach was that measuring popularity is a limitation for Twitter-based metrics which is more applicable for entertainment industries. These tweets are dangerous in medical and scientific fields.

On the other hand, a tweet by a social network is very general and public and therefore, non-scientific issues are more likely to be discussed. So, they so not have enough validity to be cited in the future. It should also be kept in mind that the users of social networks who share information are anonymous or have fake IDs. Moreover, there is no supervision on individuals. Therefore, it is obvious that they would share information irrespective of their accuracy of validity. Ultimately, researchers would not rely on these resources in their scientific articles. Another reason for the different results we found compared with the mentioned study could be the difference between the citation systems we assessed and Google Scholar, because Google Scholar considers all web sources.

We found no correlation between discussion on Facebook and citation. Facebook is a public network for group and recreational activities whose users are linked based on similar interests (Ellison, Steinfield and Lampe, 2007), and it is less used for scientific processes (Madge, Meek, Wellens and Hooley, 2009). Moreover, when Facebook users discuss medical content, it is discussed because of its application in real life rather that discussing it with the aim of citing it in the future. Therefore, discussion on Facebook does not necessarily lead to citation. Moreover, because these networks are public, the content discussed is often not valid or scientific.

We found a positive and significant relationship between discussion on Wikipedia and citation. Wikipedia is one of the elements of Web2 for enriching the learning process (Parker and chao, 2007). Therefore, Wikipedia contains more educational content than other social networks and discussion are more scientific on Wikipedia. Other researchers believe that Wikipedia Is one of the pioneering wikis. A wiki is a page or set of pages who give access to any individual for sharing or editing content. Many researchers use wikis as adjunct educational tools and students can share their opinion or edit their viewpoints (Click and Petit, 2010). Wikis can be a reliable source for scientific means since they are used to discuss and challenge scientific content.

On the other hand, we found a positive and significant correlation between recommendation by F100 and citation. Our results are consistent with Wardle's study (2010), and inconsistent with several other studies (Mohammadi & Thelwall, 2013; Allen et al., 2009; Bornmann & Leydesdorff, 2013). Wardle (2010) found that F1000 evaluations include publications related to significant achievements. Therefore, these article are more recommended by the F1000 and since they are recent, they would receive more citations. This is while biomedical publications are not evaluated by the F1000 and therefore, receive no citations. Another issue in evaluation is relationships. Wardle states that most F1000 members have sublime goals and judge fairly, but some members avoid giving a high recommendation rate to publications, which would in turn reduce the rate of citation of some articles.

To confirm these findings, Butler (2011) believed that F1000 evaluations could be related to their benefits and interests. Therefore, evaluation results could be biased. Another expressed challenge in Wardle's study was geographical bias. Evaluators who are in favor of certain geographical regions cannot correctly evaluate publications since such publications would receive more citations because of this bias. Mohammadi and Thelwall (2013) also found that there was a significant difference between citation and F1000 metrics in articles related to novel clinical performance evolutions compared with older fields of study. Researchers believe that new findings are considered more suitable for future research, and therefore, they are cited and recommended. Besides the mentioned issues, it can be stated that articles that are evaluated by the experts in that field are assessed comprehensively and a rank is given to them and articles are cited that have a higher rank.

We found a weak correlation between recommendation by F1000 and discussion on Facebook and Wikipedia and no correlation between recommendation and discussion on Twitter. In this regard, click and Petit (2010) stated that companies are transformed into powerful agencies in social networks. These companies use these networks for propagating their products and other brands. Therefore, it can be inferred that advertisements are more frequently seen in these social networks. Most probably, Twitter is not an exception and since advertisements are not evaluated by the F1000, F1000 recommendations are not necessarily and significantly related to discussion on Twitter, Facebook, or Wikipedia.

Other researchers state that due to the increasing use of social networks, more recent articles are ranked higher in the altmetrics system (Thelwall, et al., 2013). In other words, it can be inferred that the content discussed on Facebook and Wikipedia is new and recent. Therefore, they are more likely to be recommended by the F1000 and receive a higher rank. Costas, Zahedi, Wouters (2014) also confirm that altmetrics are the only valid metrics for new publications. Therefore, depending on the amount of social and virtual interaction of researchers and the general public, their role and validity for evaluating scientific publications would increase.

Conclusion

Newly emerging technologies have created new virtual and social environments for scientific publications. Currently, freely available scientific publications are available on the web and the scientific community is able to use them and provide feedback. Such feedback, named altmetrics, is used for scientific evaluations. We found that discussion on virtual networks and recommendation are two types of feedback in virtual environments. However, among the various systems, the F1000 and Wikipedia were able to provide significant feedback leading to citation.

This research has been done on biomedical field and in document level, hense it is suggested for future research to carry out on other fields and levels.

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