



**The visibility of
Wikipedia
in scholarly publications
by Taemin Kim Park**

Abstract

Publications in the Institute of Scientific Information's (ISI, currently Thomson Reuters) *Web of Science* (*WoS*) and Elsevier's *Scopus* databases were utilized to collect data about *Wikipedia* research and citations to *Wikipedia*. The growth of publications on *Wikipedia* research, the most active researchers, their associated institutions, academic fields and their geographic distribution are treated in this paper. The impact and influence of *Wikipedia* were identified, utilizing cited work found in (*WoS*) and *Scopus*. Additionally, leading authors, affiliated institutions, countries, academic fields, and publications that frequently cite *Wikipedia* are identified.

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Introduction

No one denies that *Wikipedia* is now a highly used, albeit controversial, information source. *Wikipedia* has become increasingly an important tool for "fact-checking" (Kniffel, 2008) as well as a topic of research because of its convenient access on the Web, its coverage, and the nature of large-scale collaborative work, among other reasons. According to *WorldCat* (24 August 2010), *Wikipedia* has been a topic of more than 50 theses and dissertations worldwide and has been a subject of more than 200 monographic publications.

The purpose of this study is to explore the extent of *Wikipedia*'s presence in scholarly publications in *Web of Science* (*WoS*) and Elsevier's *Scopus* databases. The Institute for Scientific Information (ISI), publisher of *WoS*, asserts that it contains the world's leading citations from multidisciplinary coverage of over 10,000 high-impact journals in the sciences, social sciences, and arts and humanities, as well as international proceedings coverage for over 120,000 conferences. *WoS* covers *Science Citation Index Expanded* indexing over 6,650 major journals, *Social Science Citation Index* containing over 1,950 journals and *Arts and Humanities Citation Index* for 1,160 of the world's leading arts and humanities journals [1]. *Scopus* states that it contains 18,000 titles from more than 5,000 international publishers, including 16,500 peer-reviewed journals in addition to about 1,200 open access journals, 600 trade publications, 2,350 book series, and 3.6 million conference papers among others [2]. Some differences in *WoS* and *Scopus* databases should be noted. The scope and types of publications included in *WoS* and *Scopus* differ and this should be taken into account in understanding the search results and interpretations. It is clear that *WoS* covers journals more selectively while *Scopus* covers a much higher numbers of conference papers. A recent study on the journal title overlap between *WoS* and *Scopus* databases reported that about 45 percent of titles in *Scopus* are not covered in *WoS*, while 16 percent of titles in *WoS* are not covered in *Scopus* (Gavel and Iselid, 2008).

Brief introduction to *Wikipedia*

Wikipedia: About page defines *Wikipedia* as a multilingual, Web-based, free-content encyclopedia project based on an openly editable model. Anyone can contribute and edit the *Wikipedia* articles. Users can contribute anonymously, or under a pseudonym, or with their real identity. The page history view (revision history or edit history) includes a list of the page's previous revisions, including date and time, the user name (or IP address) and edit history. However, Cohen (2009) reported that the English *Wikipedia* added an imposing layer of editorial reviews on articles about living people declared no longer available in the openly editable mode. Since its inception in 2001, *Wikipedia* has published 17,000,000 articles. There are currently 91,000 active contributors, and *Wikipedia* is now available in 270 languages. The English *Wikipedia* alone includes more than three million articles, 23 million pages, more than 446 million edits and is attracting 79 million visitors monthly on the Internet, as of January 2011. *Wikipedia* was founded as an offshoot of *Nupedia*, founded by Jimmy Wales and officially launched on 15 January 2001.

Among approximately three million articles in the English *Wikipedia*, there are about 3,194 (about 0.1 percent) featured articles. Featured articles represent the best articles which, according to *Wikipedia's* featured list criteria, have undergone a thorough review process by *Wikipedia's* editors to meet the highest standards for usefulness, completeness, accuracy, neutrality and style. A featured article has a small bronze star icon on the top right corner of the article's page. Citing a study conducted by researchers at the Carnegie Mellon University and Palo Alto Research Center, the *Wikipedia's* site lists the most frequently covered topics — Culture and the arts (30 percent), Biographies and persons (15 percent), Geography and places (14 percent), Society and social sciences (12 percent), History and events (11 percent), among others. Spoerri (2007) examined the popularity of topics in *Wikipedia* and found the most popular *Wikipedia* pages were related to entertainment and sexuality. Popular pages appeared to be related to search engines, especially Google. The site reports that the growth of the English *Wikipedia* in terms of new articles and contributors reached a plateau in early 2007. Landgraf (2009) also reported a reduction in *Wikipedia's* growth. Kopytoff (2011) reported on the celebration of *Wikipedia's* tenth anniversary and mentioned plans to increase the number of foreign language articles by opening an office in India, then possibly Egypt and Brazil. Plans also include the recruitment of a wider range of contributors — more women, elderly, and, to add more graphical content, museum experts.



Literature review

Reviews in the library and information science literature indicated that *Wikipedia* itself has increasingly become a subject of research from diverse academic disciplines due to its exceptional scale and utility (Medelyan, *et al.*, 2009). The concept of "information quality (IQ)," incorporating collaboration, evolving debates, and process as assurance, was studied using *Wikipedia* as an example (Stvilia, *et al.*, 2008). A *Wikipedia* entry, *Wikipedia: Academic studies of Wikipedia* (http://en.wikipedia.org/wiki/Academic_studies_about_Wikipedia) reports a partial list of academic writings about *Wikipedia* reported in journal articles, and conference proceedings among other formats and the *Academic studies about Wikipedia* page includes some *Wikipedia* research in peer-reviewed publications.

A question about *Wikipedia's* quality and reliability as an information source has been one of the most frequently investigated research topics. In an evaluation of *Wikipedia* as a reference source, applying the classic reference evaluation criteria — purpose, authority, scope, audience, cost, and format — Danny P. Wallace and Connie Van Fleet (2005) concluded that Katz's criteria for reference sources do not stand up well to *Wikipedia*. A comparison of *Wikipedia* and other encyclopedias in historical entries revealed that *Wikipedia's* accuracy was 80 percent compared with 95–96 percent accuracy in other sources (Rector, 2008). A special report by the prestigious weekly journal *Nature* (Giles, 2005) raised commentary from *Encyclopedia Britannica*. *Nature's* investigation, based on 42 science entries, found that both *Wikipedia* and *Britannica* contained numerous errors, but the difference in accuracy was not great. The average inaccuracy rate in *Britannica* was about three per article while *Wikipedia* contained about four. The number of edits, collaborators, and edit patterns were studied in relation to article quality. Wilkinson and Huberman (2007) compared the number of edits and contributors to the 1,211 "featured" articles to the same number of other articles to test the correlation between number of edits and article quality. They concluded that *Wikipedia* article quality appeared to increase on average as the number of collaborators and number of edits increase. Revising patterns — the total number of editors, the number of edits, and the number of major and minor edits — in a sample of two groups of articles were studied to determine their relationship to article quality (Poderi, 2009). The study reported that not every contribution had the same weight and major edits were not necessarily contributing to article quality. The role of main editors differed in the two groups of article. The articles in the group with a high presence of main editors tended to become featured articles more easily. Other aspects of quality such as *Wikipedia's* biased coverage and lack of cited sources were identified as "*Wikipedia risks*" (Black, 2008). Nielsen (2007) examined about 30,368 outbound links in *Wikipedia's* science entries. Although the number of linked citations to scholarly literature was small compared to the number of citations found in scientific journals, *Wikipedia* showed a slight tendency to cite articles in high-impact ISI journals. For example, the largest number of citations were to *Nature*, *Science* and the *New England Journal of Medicine* in the sample studied.

Coverage of philosophers in the twentieth century listed in *Wikipedia* and in two other widely used online resources was compared for data regarding their birth date, gender, national and disciplinary backgrounds. This study found that *Wikipedia* contained more entries for living and 'minor' philosophers than traditional

resources (Elvebakk, 2008). The semantic coverage of the English *Wikipedia* was studied and represented in terms of baseline statistics for articles, subject categories, and the top 10 authors (Holloway, *et al.*, 2007).

Use of *Wikipedia* is on the rise. While some university professors have banned using *Wikipedia* as a research source (Cohen, 2007), use of *Wikipedia* was promoted using epistemic values. Fallis (2008) argued that there were good epistemic consequences of using *Wikipedia* as a source of information by illustrating some empirical examples. Epistemic values such as power, speed, immediate availability, wiki technology, the wisdom of crowds, and *Wikipedia* policies were noted as outweighing the deficiencies in the reliability of *Wikipedia*. Despite controversies, use of *Wikipedia* by academic communities has been expanding. More positive responses to *Wikipedia* have been reported from academic libraries. For example, libraries at the University of Washington, University of North Texas, and Wake Forest University, among others, have decided to participate in *Wikipedia* by editing, adding links, or writing new articles (Lally and Dunford, 2007; Pressley and McCallum, 2008). Lim's (2009) survey on college students' use of *Wikipedia* also showed that students use it as a source for quick fact-checking and for finding background information. Student's perceptions regarding information utility and their positive emotions toward *Wikipedia* were related to their usage level. Use of *Wikipedia* in college class room has been reported. One of *Wikipedia*'s recent projects, Public Policy Initiative (http://outreach.wikimedia.org/wiki/Public_Policy_Initiative), became a teaching resource in some universities [3]. For example, five universities — Georgetown, George Washington, Harvard, Indiana University and Syracuse — were invited to work on editing articles on the policy-related entries in *Wikipedia* to improve the article quality.

Citation counts in scholarly publications have been frequently used as an important tool — to assess the relative scholarly impact of research, diffusion of new research ideas, to study journals, individual researchers, and to identify maps of scholarly communication across scientific specialties and so on (Meho and Sugimoto, 2009). Cronin and Shaw (2007) used bibliometric tools to identify Kling's intellectual impact and network using his publications, his cited works, and acknowledgment data. Others studied citing behaviors and motivations of citers besides scientific impact (Bornmann and Daniel, 2008). For the citation counts, ISI databases (such as *WoS*), *Scopus* and *Google Scholar* are the most often used tools. ISI's three citation databases were the only comprehensive citation data source until Elsevier's *Scopus* and *Google Scholar* were launched in 2004. In a paper comparing the citation counts provide by *WoS*, *Scopus* and *Google Scholar* for articles from the *Journal of the American Society for Information Science and Technology*, Bauer and Bakalbasi (2005) conclude that *Google Scholar* likely retrieves traditional journal articles which are also possibly covered by *WoS* and *Scopus* in addition to unique citations. However, the coverage of scholarly publications was the least in *Google Scholar*.



Data collection

The visibility of *Wikipedia* in scholarly communications was examined based on the following questions:

1. How many times *Wikipedia* has been a topic of research in scholarly publications covered in *WoS* and *Scopus* databases?
2. Who are the contributors most often engaged in doing research about *Wikipedia*?
3. What are these authors' institutional affiliations?
4. Which publications have published studies on *Wikipedia* most often?
5. Which academic fields are engaged in studying *Wikipedia* most frequently?
6. How often *Wikipedia* has been cited in the scholarly publications covered in *WoS* and *Scopus* databases?
7. Who cites *Wikipedia* most often?
8. Which publications cite *Wikipedia* most frequently?
9. Which academic fields cite *Wikipedia* most often?
10. Authors from which institutions most frequently cite *Wikipedia* in their publications?

Two types of data were collected to examine the visibility of *Wikipedia* in scholarly publications. The presence of *Wikipedia* in scholarly publications was assumed if a study's major topics include "*Wikipedia*," or "*Wikipedia*" has been used in their references. A search in *WoS* using *Wikipedia* in the topic OR title field was conducted in January 2011 to find the number of records for which a publication's topic is *Wikipedia*. A truncated search was used to match any variations and to achieve a more comprehensive search result. In the same way a search in *Scopus* in the title, abstract, or keyword fields was conducted. There were 291 records in *WoS* and 1,455 in *Scopus* with topics including *Wikipedia*. *Scopus* allows a search conducted beyond its own databases by providing Web searching options. Yet, this research was limited to *Scopus* alone as it includes only peer-reviewed publications.

The search result displays typical citation information including author(s), title (document), source title, its volume and number designation, pagination (if available), and publication year. From the search in *WoS*, all search results were selected to display the list of publications with a main topic on *Wikipedia* and to refine the result using ISI analysis tools. These analysis tools allow the search results to be sorted by ranked order for a selected field (*e.g.*, author, institutional name, country, etc.). For example, Brendan Luyt and Oded Nov have published most frequently on *Wikipedia* in scholarly publications covered by *WoS*. A search result in *Scopus* displays ranked lists of each field, for example, by source title, author name, publication year, affiliation, subject area, document type, etc. Advanced search features in *Scopus* were utilized for more precise and comprehensive searching. For example, a search combined with the field "affilcountry" (United States or US) displays publication output by researchers affiliated with institutions located in the United States. An "affilorg"

(Hong Kong) brings additional research output by researchers affiliated with institutions in Hong Kong. An advanced search combined with "subjarea" (comp) shows the number of documents categorized as computer science.

To examine aspects of *Wikipedia's* impact, a search for "cited work = *Wikipedia**" was conducted in *WoS*. In a "Cited Reference Search", all references in the *WoS* databases that cite *Wikipedia* were retrieved. The search result listed cited author(s), cited work (*Wikipedia*), year (if available), and the number of times cited for a specific article. There were 340 records citing *Wikipedia* in *WoS*. Once the search is executed, all entries which cite *Wikipedia* are selected, then the search is finished. One should note that the number of citing articles on the "Cited Reference Search" page and the number listed in the "Times Cited" count on the results page after finishing the search might differ depending on the scope of one's institution's subscriptions to various databases within *WoS*. The "Times Cited" count on the results page are counted from all the databases in *WoS*: *Science Citation Index Expanded*, *Social Science Citation Index*, *Arts and Humanities Citation Index*, *Conference Proceedings Citation Index-Science*, and *Conference Proceedings Citation Index-Social Sciences and Humanities*. For example, if an institution has a subscription to the *Science Citation Index Expanded* and *Social Science Citation Index*, *Arts and Humanities Citation Index* but not the *Conference Proceedings Citation Index*, the number of citing articles on the "Cited Reference Search" page may be smaller. In addition, the result may be influenced by one's subscription periods. If an institution has access to a limited time period such as from 2005 to the present, the result would probably be smaller.

Larry Dossey and Brendan Luyt cited *Wikipedia* most often in their scholarly publications as noted in *WoS*. In a similar way, a search for "refsrctitle = wikipedia*" was conducted in *Scopus* for publications with the source title (*Wikipedia*) in references. There were 3,339 records citing *Wikipedia* as source titles in references in *Scopus*. All search results were downloaded into an MS Excel file for data analysis.



Data analysis and discussion

Country productivity

There were, as of January 2011, a total of 1,746 publications in *WoS* and *Scopus* for the period 2002 to 2010, which contained research about *Wikipedia*. The number should be taken with caution due to overlapping coverage of publications between *WoS* and *Scopus* as noted earlier. Furthermore, these numbers may change as the coverage of publications in the *WoS* and *Scopus* databases is updated.

To achieve a more precise measurement of research production by country, Hong Kong was searched separately and added to China's production for data analysis. China's production included three additional publications from Hong Kong in *WoS*. Likewise, for the United Kingdom, additional searches were conducted in *WoS* for England, Scotland, Wales, and Northern Ireland. Four publications from Scotland were added to the United Kingdom's total. In a similar manner, an additional country search for Hong Kong in *Scopus* added 18 more publications to China. The country name, United Kingdom, was used consistently in *Scopus* for all publications affiliated with that nation. [Table 1](#) lists the most productive countries in *Wikipedia* research. The most productive countries were the U.S. and the United Kingdom in *WoS* and the U.S. and Germany in *Scopus*. The next most productive countries were China, France, the United Kingdom, Japan, Italy and the Netherlands in *Scopus*. The U.S. is far stronger in producing research on *Wikipedia* than any other country, accounting for about 22 percent of the publications in *Scopus* and about 37 percent in *WoS*.

| Country | Number of publications in <i>WoS</i> (percent) | Country | Number of publications in <i>Scopus</i> (percent) |
|-----------------------------|--|-----------------------------|---|
| United States | 107 (36.8) | United States | 315 (21.6) |
| United Kingdom | 25 (8.6) | Germany | 137 (9.4) |
| Germany | 22 (7.6) | China (including Hong Kong) | 99 (6.8) |
| Canada | 13 (4.4) | France | 69 (4.7) |
| Australia | 12 (4.2) | United Kingdom | 65 (4.5) |
| China (including Hong Kong) | 12 (4.2) | Japan | 64 (4.4) |
| France | 11 (3.8) | Italy | 57 (3.9) |
| Italy | 9 (3.1) | Netherlands | 57 (3.9) |

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|-------------|---------|-----------|----------|
| Spain | 9 (3.1) | Australia | 55 (3.8) |
| Netherlands | 9 (3.1) | Spain | 50 (3.4) |
| Singapore | 9 (3.1) | Canada | 42 (2.9) |

Author productivity

Analysis of author productivity, based on the number of publications included in *WoS* and *Scopus*, indicated that a small numbers of authors created a number of publications. There were 291 publications with a total of 701 authors in *WoS* and 1,455 publications in *Scopus* with a total of 3,940 principal and collaborative authors with a research topic including *Wikipedia*. Multiple authorship was the norm. For example, one publication about *Wikipedia* research in *Scopus* was coauthored by 37 individuals.

Two individuals wrote 13 papers, another two researchers contributed 12 publications, and six published 10 items about *Wikipedia*. Altogether, 123 individuals wrote more than four publications on *Wikipedia*. The most highly productive 15 individuals, their affiliated institutions, countries, and the number of their publications are listed in [Table 2](#). Individual researchers who developed the most frequent publications were affiliated with institutions located in Europe and Asian countries. Jaap Kamps at the University of Amsterdam (<http://staff.science.uva.nl/~kamps/>) and Gerhard Weikum of the Max-Planck-Institut für Informatik (<http://www.mpi-inf.mpg.de/~weikum/>) each wrote 13 articles dealing with, in some fashion, *Wikipedia*.

| Name | Affiliation | Country | Number of publications |
|---------------|-------------------------------------|---------------|------------------------|
| Kamps, J. | University of Amsterdam | Netherlands | 13 |
| Weikum, G. | Max-Planck-Institut für Informatik | Germany | 13 |
| Geva, S. | Queensland University of Technology | Australia | 12 |
| Nakayama, K. | Osaka University | Japan | 12 |
| Koolen, M. | University of Amsterdam | Netherlands | 10 |
| Hara, T. | Osaka University | Japan | 10 |
| Kittur, A. | Carnegie Mellon University | United States | 10 |
| Ortega, F. | Universidad Rey Juan Carlos | Spain | 10 |
| Nishio, S. | Osaka University | Japan | 10 |
| Sun, A. | Nanyang Technological University | Singapore | 10 |
| Demartini, G. | L3S Research Center | Germany | 8 |
| Jijkoun, V. | University of Amsterdam | Netherlands | 8 |
| Milne, D. | University of Waikato | New Zealand | 8 |
| Trotman, A. | University of Otago | New Zealand | 8 |
| Witten, I.H. | University of Waikato | New Zealand | 8 |

Affiliated institution productivity

The majority of researchers on *Wikipedia* were affiliated with universities. The most productive 15 institutions are listed below in ranked order, in [Table 3](#). Individual researchers affiliated with the University of Amsterdam, Nanyang Technological University and the Max-Planck-Institut für Informatik were the most productive in doing research on *Wikipedia*. These 15 affiliated institutions contributed 230 publications which were about 13 percent of the total publications in *WoS* and *Scopus*. Researchers affiliated with the Carnegie Mellon University and Indiana University were most active in research on *Wikipedia* in the United States.

| Institution | Number of papers |
|--|------------------|
| University of Amsterdam | 31 |
| Nanyang Technological University | 23 |
| Max-Planck-Institut für Informatik | 19 |
| Queensland University of Technology | 17 |
| Carnegie Mellon University | 17 |
| University of Tokyo | 16 |
| Indiana University | 15 |
| University of Illinois at Urbana-Champaign | 12 |
| Hewlett-Packard Laboratories | 12 |
| Osaka University | 12 |
| Shanghai Jiao Tong University | 12 |
| University of Washington | 11 |
| IBM Thomas J. Watson Research Center | 11 |
| Georgia Institute of Technology | 11 |
| Microsoft Research | 11 |

Academic fields which are most active in Wikipedia research

[Table 4](#) describes 10 academic fields which are most active in *Wikipedia* research according to *WoS* and *Scopus*. Academic fields in this study were defined by these databases respectively. *Scopus* categorizes its content into 27 subject areas and *WoS* includes 251 subject areas. Certainly, computer science was the most productive. About 42 percent of *Wikipedia* research is produced from many areas in the computer science fields and about 26 percent from information and library science in *WoS* databases while in *Scopus* about 72 percent of research originates from the computer science category as defined by *Scopus*. The fields of mathematics, social sciences, and engineering are also highly productive. In *Scopus* an exceedingly small portion of publications, about one percent of *Wikipedia* research output, derives from the arts and humanities. Note that a publication may be categorized in more than one subject category and thus the total number of publications may include duplication.

| Academic fields (<i>WoS</i>) | Number of publications (percentage) | Academic fields (<i>Scopus</i>) | Number of publications (percentage) |
|---|---|--|---|
| Information science, Library science | 74 (25.6) | Computer science | 1,052 (72.3) |
| Computer science, Information systems | 73 (25.2) | Mathematics | 341 (23.4) |
| Computer science, Artificial intelligence | 24 (8.3) | Social sciences | 260 (17.9) |
| Engineering, Electrical and electronic | 19 (6.6) | Engineering | 199 (13.7) |
| Communications | 16 (5.5) | Biochemistry, Genetics and molecular biology | 109 (7.5) |
| Computer science, Theory and methods | 13 (4.5) | Decision sciences | 99 (6.8) |
| Education and education | 13 (4.5) | Business, Management, | 85 (5.8) |

| | | | |
|---|-------------|---|-------------|
| research | | Accounting | |
| Management | 13 (4.5) | Medicine | 44 (3.0) |
| Computer science, Hardware and architecture | 12 (4.2) | Agriculture and Biological sciences, Arts | 16 (1.1) |
| Multidisciplinary sciences | 10 (3.5) | Arts and humanities | 15 (1.0) |
| | | Physics and Astronomy | 15 (1.0) |

The leading publications reporting research on Wikipedia

Table 5 rank orders the 11 most productive publications on *Wikipedia* research in both *WoS* and *Scopus*. It appears that more research about *Wikipedia* has been published in conference papers and proceedings than in journal articles. As conference titles tend to vary frequently, more comprehensive searches for conference publications were conducted. Series such as *Lecture Notes in Computer Science* including the subseries *Lecture Notes in Artificial Intelligence*; *Lecture Notes in Bioinformatics*; *Proceedings of the International Conference on Information and Knowledge Management*; and, *International Symposium on Wikis* (with slightly variant titles) are the leading outlets for *Wikipedia* research. *Lecture Notes in Computer Science* is a major series; a WorldCat search retrieves more than 100,000 items. The *International Symposium on Wikis'* Web site reports that it focuses on research and practice about wikis and open collaboration. Thus it appears to be a very appropriate venue for *Wikipedia* research. *First Monday* is also highly regarded in publishing *Wikipedia* research. Because of the coverage differences between *WoS* and *Scopus*, *Wikipedia* research is most often reported in journals in *WoS* and conference proceedings in *Scopus*. However, it is noteworthy that the *Journal of American Society for Information Science and Technology (JASIST)* appears on both lists. The top 11 publications produced about 20 percent of the *Wikipedia* research in *WoS* compared to about 37 percent in *Scopus*. It is interesting that *Wikipedia* research appears to be concentrated in a small number of publications as recorded in *Scopus* while scattered among a larger number in *WoS*.

| Table 5: Leading serials publishing <i>Wikipedia</i> research. | | | |
|---|---------------|---|---------------|
| Publication as reported in <i>WoS</i> | Number | Publication as reported in <i>Scopus</i> | Number |
| <i>Journal of American Society for Information Science and Technology</i> | 14 | <i>Lecture Notes in Computer Science</i> , including subseries <i>Lecture Notes in Artificial Intelligence</i> and <i>Lecture Notes in Bioinformatics</i> | 292 |
| <i>Online Information Review</i> | 6 | <i>Proceedings of International Conference on Information and Knowledge Management</i> | 61 |
| <i>Journal of Computer-mediated Communication</i> | 5 | <i>International Symposium on Wikis</i> | 53 |
| <i>Journal of Web Semantics</i> | 5 | <i>International ACM SIGIR Conference on Research and Development in Information Retrieval</i> | 29 |
| <i>BMC Bioinformatics</i> | 4 | <i>First Monday</i> | 26 |
| <i>Computers in Human Behavior</i> | 4 | <i>AAAI Workshop Technical Report</i> | 14 |
| <i>Electronic Library</i> | 4 | <i>Journal of American Society for Information Science and Technology</i> | 14 |
| <i>Information Systems</i> | 4 | <i>Proceedings of AAAI National Conference on Artificial Intelligence</i> | 13 |
| <i>Nature</i> | 4 | <i>Proceedings of ACM Conference on Human</i> | 12 |

| | | <i>Factors in Computing Systems</i> | |
|--------------------------------|---|---|----|
| <i>Information Retrieval</i> | 4 | <i>Proceedings of ACM Conference on Computer Supported Cooperative Work</i> | 12 |
| <i>New Media & Society</i> | 4 | <i>International Conference on Knowledge Discovery and Data Mining</i> | 11 |

Impact of Wikipedia

Citations to *Wikipedia* in scholarly publications were examined to test *Wikipedia*'s impact on scholarly communication. This effort attempted to identify those who cite *Wikipedia* most often, their affiliated institutions, associated fields, and geographic distribution.

Wikipedia was cited 3,679 times in the *WoS* and *Scopus* databases. The 11 researchers who cited *Wikipedia* most frequently in their scholarly publications were from eight countries. Saou-Wen Su, affiliated with the Lite-On Technology Corporation in Taiwan, cited *Wikipedia* in eight publications; Gerhard Weikum of the Max-Planck-Institut für Informatik cited *Wikipedia* in in seven publications. [Table 6](#) lists individual researchers who cited *Wikipedia* most frequently in their papers as recorded by *Scopus* and *WoS*.

| Name | Country | Number |
|-------------------------|----------------|---------------|
| Su, Saou-Wen | Taiwan | 8 |
| Weikum, Gerhard | Germany | 7 |
| Boukerche, Azzedine | Canada | 6 |
| Ortega, Felipe | Spain | 6 |
| Ren, Y. | United States | 6 |
| Ros, L. | France | 5 |
| Hijazi, H. | France | 5 |
| González-Barahona, J.M. | Spain | 5 |
| Milne, David | New Zealand | 5 |
| Witten, Ian H. | New Zealand | 5 |
| Wong, K.L. | Malaysia | 5 |

Citations to Wikipedia by affiliated institutions

As illustrated below, authors affiliated with institutions in the U.S. appear to cite *Wikipedia* more often in their scholarly publications than authors in any other country. Researchers affiliated with Carnegie Mellon University, Georgia Institute of Technology, and Indiana University were most active in citing *Wikipedia*. The most highly citing affiliated institutions are rank ordered in [Table 7](#). International researchers affiliated with universities in Asian countries — Nanyang Technological University, University of Hong Kong, Tsinghua University, and Chinese University of Hong Kong — cited *Wikipedia* most frequently. Nanyang Technological University, Carnegie Mellon University, Indiana University, and Tsinghua University were also listed among the 15 institutions which are most productive in *Wikipedia* research as well.

| Institution | Number of citations |
|--|----------------------------|
| Carnegie Mellon University | 23 |
| Georgia Institute of Technology | 19 |
| Indiana University | 17 |
| Institute of Electrical and Electronics Engineers (IEEE) | 16 |
| Nanyang Technological University | 15 |
| University of Hong Kong | 15 |

| | |
|---------------------------------------|----|
| Purdue University | 15 |
| New York University | 15 |
| Tsinghua University | 15 |
| Chinese University of Hong Kong | 14 |
| Arizona State University | 14 |
| University of California, Berkeley | 14 |
| University of California, Los Angeles | 14 |

Citations to Wikipedia by country

Table 8 lists the number of citations to *Wikipedia* by country. Researchers from the U.S., China, United Kingdom, Germany and Canada most frequently cite *Wikipedia* according to *Scopus* while the U.S., United Kingdom, Canada, and Germany cite the most in the *WoS* database. For the United Kingdom's total, an additional four citations from Scotland were added. Likewise, a combined search with "affilcountry" (Hong Kong) brought an additional 42 citations by researchers affiliated with institutions in Hong Kong in *Scopus* which were added into China. Scholars in the U.S., Germany, United Kingdom, China, and France were most active in generating research on *Wikipedia* while researchers affiliated in the U.S., United Kingdom, Germany, and China cited *Wikipedia* most often. American scholars are strong in both *Wikipedia* research and citing *Wikipedia* in their publications. However, a closer look reveals that U.S. scholars are more likely to cite *Wikipedia* than to actually produce research on *Wikipedia* itself. American scholars account for about 37 percent of published research on *Wikipedia* in *WoS* and 22 percent in *Scopus* whereas they produce 43 percent of the citations to *Wikipedia* in *WoS* and 27 percent in *Scopus*.

| Country | Numbers cited in <i>WoS</i> (percent) | Country | Numbers cited in <i>Scopus</i> (percent) |
|-------------------------------------|---------------------------------------|-----------------------------|--|
| United States | 146 (43) | United States | 908 (27) |
| United Kingdom (including Scotland) | 19 (5.6) | China (including Hong Kong) | 212 (6.3) |
| Canada | 18 (5.3) | United Kingdom | 196 (5.8) |
| Germany | 14 (4.1) | Germany | 158 (4.7) |
| Australia | 11 (3.2) | Canada | 138 (4.1) |
| Singapore | 9 (2.7) | Australia | 116 (3.5) |
| China | 8 (2.4) | France | 78 (2.3) |
| Taiwan | 8 (2.4) | Japan | 75 (2.2) |
| Austria | 7 (2.1) | Italy | 63 (1.9) |
| France | 7 (2.1) | Netherlands | 62 (1.9) |
| Netherlands | 7 (2.1) | Spain | 46 (1.4) |

Scholarly publications citing Wikipedia most often

The publications in *WoS* and *Scopus* which most cite *Wikipedia* were identified and are rank ordered in **Table 9**. Among the 22 publications that produced the most research about *Wikipedia*, four — namely *Lecture Notes in Computer Science* (with subseries), *Proceedings of the International Symposium on Wikis, First Monday* and *Journal of the American Society for Information Science and Technology* — also cited *Wikipedia* most frequently. Interestingly, in *WoS* the 10 most frequently citing publications contain about 12 percent of the total citations to *Wikipedia* while the 11 publications most active in producing *Wikipedia* research comprise about 20 percent of the publications about it. Likewise, in *Scopus* the 10 most highly citing publications

contain only 12 percent of the relevant citations whereas the top 11 publications on *Wikipedia* research contain about 37 percent of pertinent publications. *Wikipedia* research is highly concentrated in a relatively few publications whereas citations to *Wikipedia* are scattered among a larger number of diverse publications in both *WoS* and *Scopus*. Thus, *Wikipedia*'s impact on scholarly communications appears to be stronger through citations *to* it rather than through publications *about* it.

| Table 9: Publications in <i>WoS</i> and <i>Scopus</i> which cite <i>Wikipedia</i> most often. | | | |
|--|---|---|---|
| Publications in <i>WoS</i> | Number of publications (percent) | Publications in <i>Scopus</i> | Number of publications (percent) |
| <i>Lecture Notes in Computer Science</i> | 11 (3.2) | <i>Lecture Notes in Computer Science</i> , including the subseries <i>Lecture Notes in Artificial Intelligence</i> and <i>Lecture Notes in Bioinformatics</i> | 202 (6) |
| <i>Journal of American Society for Information Science and Technology</i> | 6 (1.8) | <i>Proceedings of the International Symposium on Wikis</i> | 33 (1) |
| <i>Publications of the Modern Language Association of America (PMLA)</i> | 5 (1.5) | <i>Proceedings of SPIE (International Society for Optical Engineering)</i> | 30 (<1) |
| <i>Computers & Security</i> | 4 (1.2) | <i>Proceedings of ACM International Conference Series</i> | 28 (<1) |
| <i>Explore: The Journal of Science and Healing</i> | 4 (1.2) | <i>Conference Proceedings of the American Society for Engineering Education (ASEE)</i> | 26 (<1) |
| AAA — <i>Arbeiten aus Anglistik und Amerikanistik</i> | 3 (0.9) | <i>First Monday</i> | 21 (<1) |
| <i>Journal of Universal Computer Science</i> | 3 (0.9) | <i>Proceedings of the International Conference on Information and Knowledge Management</i> | 20 (<1) |
| <i>Athletic Therapy Today</i> | 2 (0.6) | <i>Journal of the American Society for Information Science and Technology</i> | 15 (<1) |
| <i>Biochemistry and Molecular Biology Education</i> | 2 (0.6) | <i>Communications in Computer and Information Science</i> | 14 (<1) |
| <i>Clinical Orthopedics and Related Research</i> | 2 (0.6) | <i>Proceedings of the ACM Conference on Human Factors in Computing Systems</i> | 13 (<1) |

Academic fields citing Wikipedia most often

Table 10 displays the 12 academic fields which cite *Wikipedia* the most often as noted in *WoS* and *Scopus*. About 16 percent of the citations to *Wikipedia* originate from computer science fields, about 10 percent from information and library science, about six percent from literature, and about four percent from communications and engineering in *WoS*. In *Scopus*, about 42 percent of citations come from computer science, 24 percent from engineering, and another 21 percent from the social sciences. The computer science field displays both the highest proportion of *Wikipedia* research and citations to *Wikipedia*. The fields of engineering (24 percent), and medicine (14 percent) are quite active in citing *Wikipedia* in their publications. In contrast, 14 percent of *Wikipedia* research derives from engineering, and three percent from medicine. Mathematicians contribute a larger proportion of the *Wikipedia* research (23 percent) than the citations to it (11 percent). The proportions are nearly equal for social scientists who produce 18 percent of the *Wikipedia* research and 21 percent of the citations. In the arts and humanities the proportion of citations to *Wikipedia* (about four percent) is also greater than the proportion of research publications about *Wikipedia* (about one percent). Remember that a publication may be assigned to more than one subject category so citation counts by fields may include duplicates.

| Academic fields identified in <i>WoS</i> | Number of citations (percent) | Academic fields identified in <i>Scopus</i> | Number of citations (percent) |
|---|--------------------------------------|--|--------------------------------------|
| Information science and Library science | 34 (9.9) | Computer science | 1,419 (42.5) |
| Computer science, Information systems | 27 (7.9) | Engineering | 797 (23.8) |
| Literature | 19 (5.5) | Social sciences | 711 (21.3) |
| Computer science, theory and methods | 17 (4.9) | Medicine | 483 (14.5) |
| Communications | 13 (3.8) | Mathematics | 366 (10.9) |
| Engineering, electrical and electronic | 13 (3.8) | Biochemistry, Genetics and Molecular biology | 183 (5.5) |
| Computer science, software engineering | 11 (3.2) | Arts and Humanities | 149 (4.5) |
| Education and Education research | 11 (3.2) | Business, Management and Accounting | 139 (4.2) |
| Law | 9 (2.6) | Physics and Astronomy | 139 (4.2) |
| Humanities, Multidisciplinary | 8 (2.3) | Material science | 109 (3.3) |
| Language and Linguistics | 8 (2.3) | Decision science | 102 (3.1) |
| Languages | 8 (2.3) | Nursing | 83 (2.5) |

Wikipedia's increasing visibility in scholarly communications

Scholarly research about *Wikipedia* apparently first appeared in the 3 June 2002 issue of *First Monday*, in paper entitled "Open source intelligence" by Felix Stalder and Jesse Hirsh [4] as well as in a 2002 article in *Online* entitled "Péter's picks and pans review on *Wikipedia*" by Péter Jacsó [5]. **Table 11** summarizes the pertinent data about *Wikipedia* in *WoS* and *Scopus* from 2002 to 2010. As the Table 11 illustrates, research about and citations to *Wikipedia* in scholarly publications have steadily increased over time since its launch in 2001. Although citations to *Wikipedia* in *WoS* peaked in 2007, there is substantial evidence in citation patterns to demonstrate the significant impact of *Wikipedia* on scholarly communication over the past decade, corresponding to its increased use as an information resource.

Table 11: Research about *Wikipedia* and citations to *Wikipedia*, by year.

| Year | Number of research publications identified in <i>Scopus</i> | Number of citations identified in <i>Scopus</i> | Number of research publications identified in <i>WoS</i> | Number of citations identified in <i>WoS</i> |
|------|---|---|--|--|
| 2002 | 2 | 0 | 2 | 1 |
| 2003 | 0 | 4 | 0 | 0 |
| 2004 | 3 | 39 | 0 | 10 |
| 2005 | 19 | 97 | 7 | 24 |
| 2006 | 80 | 303 | 22 | 70 |
| 2007 | 209 | 491 | 33 | 81 |
| 2008 | 340 | 592 | 65 | 57 |
| 2009 | 390 | 880 | 76 | 48 |
| 2010 | 412 | 933 | 86 | 49 |

Tables [12](#) and [13](#) present data about the types of publications that, respectively, write about and cite *Wikipedia*. Table 12 shows that in *Scopus* research about *Wikipedia* has been published predominantly in conference papers (63 percent), articles (26 percent), and review papers (three percent) among other formats, while in *WoS* it has been published more frequently in articles (65 percent), proceeding papers (nine percent), and editorial materials (seven percent). However, *Wikipedia* tends to be more highly cited in journal articles as shown in Table 13: 30 percent in *Scopus* and 70 percent in *WoS*. Only seven percent of the citations in *WoS* were to conference papers, contrasted to 31 percent in *Scopus*. In summary, the visibility of *Wikipedia* research is more prominent in conference and proceedings papers while citations to *Wikipedia* are more prevalent in journal articles.

Table 12: Types of publications publishing research about *Wikipedia*.

| Document type identified in <i>WoS</i> | Number (percent) | Document type identified in <i>Scopus</i> | Number (percent) |
|--|------------------|---|------------------|
| Articles | 188 (65.0) | Conference papers | 921 (63.2) |
| Proceedings papers | 25 (8.7) | Articles | 385 (26.4) |
| Editorial material | 21 (7.2) | Reviews | 47 (3.2) |
| Book reviews | 15 (5.2) | Conference reviews | 46 (3.1) |
| Letters | 11 (3.8) | | |
| News items | 10 (3.4) | | |
| Other | 21 (7.2) | Other | 56 (3.8) |

Table 13: Types of publications citing *Wikipedia*.

| Document type identified in <i>WoS</i> | Number (percent) | Document type identified in <i>Scopus</i> | Number (percent) |
|--|------------------|---|------------------|
| Articles | 239 (70.3) | Conference papers | 1,046 (31.3) |
| Editorial material | 39 (11.5) | Articles | 995 (29.8) |
| Proceedings papers | 24 (7.1) | Reviews | 258 (7.7) |

| | | | |
|--------------|-------------|--------------------|-------------|
| Reviews | 19 (5.5) | Editorial material | 54 (1.6) |
| Book reviews | 12 (3.5) | Short surveys | 21 (<1) |
| Letters | 6 (1.7) | Notes | 17 (<1) |



Summary and conclusions

Since *Wikipedia* was launched in 2001, the number of research publications about *Wikipedia* and citations to *Wikipedia* has increased steadily. There were a total of 1,746 publications included in *WoS* and *Scopus* for the years 2002 to 2010.

Research about *Wikipedia* has been published most frequently by individual researchers who are affiliated with academic institutions in Europe and Asian countries — Netherlands, Germany, Australia and Japan. However, the largest proportion of research on *Wikipedia* has been contributed by scholars in academic institutions in the U.S. (about 37 percent in *WoS* and 22 percent in *Scopus*), followed by scholars from Germany, United Kingdom, and China. Researchers in universities are the major contributors to *Wikipedia* research. The University of Amsterdam in the Netherlands and the Max-Planck-Institut für Informatik in Germany were the most active in producing research on *Wikipedia*. Analysis by discipline shows that the most frequent contributors to *Wikipedia* research are computer scientists, information scientists, and mathematicians. For example, the *Lecture Notes in Computer Science* (with subseries) and *Proceedings of the International Symposium on Wikis* (with variant titles) have published more *Wikipedia* research than any other publications. Conference publications and journal articles are the major venues for reporting research on *Wikipedia*.

Wikipedia's citation rates in scholarly publications have been consistently increasing. It was cited 3,679 times in the *WoS* and *Scopus* databases during the last nine years. Academic institutions are not only the major producers of *Wikipedia* research but also the major consumers that cite *Wikipedia* most often. The rate of citing was highest among scholars from the US, United Kingdom, Germany, and China. *Wikipedia* has been cited in more than 30 countries and by 306 institutions worldwide in *WoS* alone. Authors affiliated with academic institutes in the U.S. appear to cite *Wikipedia* most frequently. American scholars tended to cite *Wikipedia* to a greater extent than they published research about it. Researchers affiliated with Carnegie Mellon University, Georgia Institute of Technology, and Indiana University were the most active in citing *Wikipedia* in their publications. Scholars in the fields of computer science, information science and social sciences are the most active in citing *Wikipedia*. Interestingly, researchers in engineering and medicine cite *Wikipedia* more often than do research on *Wikipedia*, while researchers in mathematics more often write about *Wikipedia* than cite it. Arts and humanities also give more citations to *Wikipedia* than conduct research about it. *Wikipedia* research is most likely to be published in conference and proceedings papers, then journal articles along with other formats. However, citations to *Wikipedia* were more often found in journal articles followed by conference papers and then editorial materials. A few publications contain a high portion of *Wikipedia* research while citations were scattered in a wider range of publications. The breath of *Wikipedia's* impact has stretched to authors in many fields and professional areas.

Reported numbers regarding the writing about and citing of *Wikipedia* should be taken carefully as they reflect only a snapshot provided by several databases. Since this research is based only on *WoS* and *Scopus*, publications included in these databases are mostly in English. Finally, book reviews, editorial material, letters, and news items (which constitute a significant portion of publications about *Wikipedia* in *WoS*) are not strictly speaking "research," but they nevertheless are indicative of *Wikipedia's* impact on the scholarly communication.

This research adds to our understanding of *Wikipedia's* role in scholarship and reflects scholarly regard in some sense for a highly controversial yet well used resource on the Internet. This bibliometric study demonstrates *Wikipedia's* visibility in the scholarly communication process — productivity of scholars, affiliated institutions, academic fields, and the geographic distribution of affiliated institutions, and the type of publications. The influence of *Wikipedia* on the scholarly community as indicated by citations was identified in the course of this research. Hence this paper sheds some light on trends regarding *Wikipedia's* place in formal scholarship and demonstrates its growing visibility.

Recent involvement by higher education communities in *Wikipedia* implies *Wikipedia's* potential to become not only a reliable resource but also a learning and teaching tool for students. *Wikipedia's* plans to include more women and elderly as well as expanding international offices will bring balance and wholeness in content. As demonstrated in this study, active research on *Wikipedia* and citations to *Wikipedia* testifies to *Wikipedia's* position as a rich resource. The increasing scholarly attention to *Wikipedia* suggests a growing acceptance of its credibility as a valid information resource.

This study is only a small step in demonstrating the visibility of *Wikipedia* in scholarly communication. Identifying major topics covered in scholarly publications about *Wikipedia* may be addressed in future

research. Other issues — such as examining gender differences, co-author networks in *Wikipedia* research, and motivations for citing *Wikipedia* — could add further details on the utility of *Wikipedia* in scholarship. 

About the author

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Notes

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