Mendeley Readership Characteristics of Library and Information Science Articles: An Altmetric Exploration

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Article Info

Objective: The present study assesses the occupation, discipline and location-wise Mendeley readership characteristics of LIS articles. Besides, the study analyzed the association between citations and Mendeley readership.

Methods: Data for the analysis were collected from the WoS database by searching the keyword "Information science and Library science" through the advanced search feature. To extract the Mendeley readership of the articles, Webometric Analyst 4.1 was used. It was found that out of 16796 articles, 8370 (44.12%) articles have a readership.

Results: Nine user categories were reported to read LIS papers, and PhD/doctoral students were the most readers with 147217 readers, followed by postgraduate/master's students with 112597 readers. Readers from the Computer Science discipline were found to be the most intake of the LIS articles with 99001 reads, followed by readers from Engineering (88210). Geographically, the highest readership was recorded in the United States with 8442 readers, Malaysia with 1809 readers and Brazil with 1720 readers. A low positive correlation was reported between the citations and Mendeley readership for the articles, and the association did not become strong in the longer term.

Conclusion: The study's findings offer a hint for scientometricians to use Mendeley metrics for measuring the early impact of LIS articles along with the traditional citation metrics.


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Introduction

Evaluating the impact of research is always essential for researchers for various reasons. The traditional citation metrics for the impact evaluation were criticized for their inefficiency in measuring the social impact of the research and thus, the new social media metrics, also known as altmetrics emerged in 2010 (Mohammadi & Thelwall, 2014). Altmetrics are web-based metrics for measuring the impact of scholarly material, emphasizing social media such as Facebook, Wikipedia, blogs, Twitter, YouTube, Mainstream media, Mendeley and so on (Holmberg et al., 2019). It lets the journal publishers showcase the social impact of their published articles through the altmetric indicators, including the Plum Print of PlumX Metrics or rainbow doughnut of Altmetric.com (Thelwall, 2020). Individual researchers can also analyze the impact of their papers through the Impactstory (Orduna-Malea & Delgado López-Cózar, 2017).

Mendeley is a powerful reference management tool that helps the global research community to join and collaborate works (Parabhoi & Verma, 2020; Jeng et al., 2015). The Mendeley readership of the scholarly output has become a novel measure of the early social impact of the research since it usually appears before citations (Zahedi & Haustein, 2018). The number of registered users who bookmarked a paper on the Mendeley platform indicates the readership. The users might not have read the article or might be interested in reading it later (Thelwall, 2020). Previous studies by Eldakar (2019), Haustein and Lariviere (2014) and Nath et al. (2020) showed promising results when Mendeley bookmarks were associated with citations and can be justified that they can be used as supplementary to the traditional metrics. The studies exploring the Mendeley readership of LIS articles are fewer in number, especially with a large dataset to make a firm decision that Mendeley readership can be used along with traditional citation metrics for impact evaluation. Hence, the present study was carried out to fill this gap by considering a large LIS dataset from the WoS database. The entire study is driven by the following four research questions.

Research Questions

RQ1: Who are the significant readers of LIS articles on Mendeley?

RQ2: What disciplines are more interested in reading LIS articles on Mendeley?

RQ3: Readers from how many countries read LIS articles through Mendeley?

RQ4: Will the correlation between citations and readership for LIS articles become strong in the long term?

Literature Review

Mendeley readership analysis is a core area in the 'altmetrics research' on which fewer studies have been conducted. Most relevant studies are critically reviewed in this section.
Parabhoi and Verma (2020) explored the Mendeley readership count of 391 articles from the DESIDOC Journal of Library and Information Technology published from 2012 to 2018 and reported Mendeley readership for the articles was decreasing as the years passed by. The highest readership for the articles was recorded in 2014, with 1183 total readers. Zahedi et al. (2017) showed that Mendeley's readership was higher for the latest articles which stood against this finding. Maflah and Thelwall (2014) observed that LIS articles attracted more Mendeley readers than its citations and the possible reason was that outputs draw readers from different disciplines. Students and Librarians were the top readers of the articles, and most of them belonged to the social science domain with 2737, out of which 237 readers were from India, with a positive correlation between the Scopus citation and Mendeley readership (r=0.3217).

Mohammadi and Thelwall (2014) gauged the Mendeley altmetrics of different social science and humanities fields. Articles indexed in WoS in the year 2008 were selected. The findings depicted 44% of the pieces from social science, and 13% of the papers from Humanities showed their presence on Mendeley which holds the second position after Life and Earth science if we compare the result with a similar kind of study by Zahedi and Haustein (2018). Psychology (54%) and linguistics (34%) had the highest coverage in Mendeley, which corroborates the study findings of Haustein et al. (2014). There was a positive association between the WoS citations with the Mendeley readership of the articles from Social Science (r=0.516, p<.01) and Humanities (r=0.428, p<.01). Thelwall (2019) in another study found Scopus citations strongly correlated with Mendeley bookmarks in the long term in humanities.

Maleki (2015) investigated the Mendeley readership of Iranian articles. A total of 31629 articles indexed in WoS from 2000-2012 were analyzed; findings showed that 53% of the articles (16667 articles) had coverage on Mendeley. Life Science and Biomedicine fields had the highest range (65%). PhD and master's students were the top readers of the articles with 30% and 17%, respectively. For LIS journals, the highest readership was found among students (Bwsrang et al., 2022). The geographical results showed that US readers had outnumbered other countries. The papers from medical sciences indexed in WoS were highly correlated with Mendeley readership (r=0.7), as Thelwall and Wilson (2016) reported. Ergut and Camkıran (2021) assessed the Mendeley readership characteristics of 1560 articles authored by Turkish authors in the field of Economics, Econometrics and Finance from 2016 to 2018 and reported a positive correlation between the citations with the Mendeley readership for all these years with the highest correlation in the year 2017 (r=0.664).

Ravikumar et al. (2022) carried out a study to measure the correlation between citations and Mendeley's readership of articles authored by Sri Lankan authors. Articles indexed in the WoS database with a minimum of 5 citations were traced and subjected to a correlation test. The findings revealed that articles with higher Mendeley bookmarks were strongly positively correlated with
WoS citations. Articles with below 200 bookmarks showed a negative correlation between these two indicators. Nawaz et al. (2023) investigated the professional status of the readers of Dr. Saeed-Ul Hassan's articles in Mendeley. They found that doctoral and master's students as well as researchers paid more attention to Saeed-Ul Hassan's articles. It is worth mentioning that this amount of attention has been among the researchers of the American and European continents more than other continents. Parabhoi et al. (2023) explored the Mendeley readership statistics of 9 LIS journals indexed in the Scopus database. The study aimed to find whether early Mendeley readership correlates with the later citation for the sampled journals. The study found that among the 9 journals, DESIDOC Journal of Science and Technology got the highest number of early citations and readerships. In contrast, the Malaysian Journal of Library and Information Science got a higher number of later citations and bookmarks from Mendeley. The correlation test showed that the early citations and readerships were positive for all the investigated journals ranging from weak to moderate. The highest association was reported for Progress in informatics with a correlation coefficient value of .605.

**Materials and Methods**

The entire study was carried out in two significant steps. The first step involved the selection of LIS articles and extracting the corresponding citations. To select the articles, the WoS database was accessed. The advanced search feature of the database was used. The WoS category "(WC=Library Science and Information Science)" was searched and further refined the results by selecting the research output as 'Articles', timespan from '2010-2015', language as 'English' and index including 'Science Citation Index Expanded, Social Science Citation Index and Arts & Humanities Index'. Thus, a total of 18969 articles were retrieved. Since citation takes time to accrue, the period was selected from 2010 to 2015, letting the articles get enough citations to correlate against Mendeley bookmarks. The results were exported to Excel, and additional separate files were prepared for each year. The results included the important bibliographic details of the articles like authors, title, journal, DOI, citations, etc.

The second step comprised extracting the Mendeley readership of the outputs, Webometric Analyst software version 4.1 was used. The DOI of the articles in each year was saved in tab- limited format. Each Excel file was uploaded to the software and the corresponding readership statistics of the articles (N=16796) were extracted. The result was further copied for subsequent analysis. To check the correlation between the readership and citation, a separate Excel was generated having WoS citations and the Mendeley column of readers. Some articles did not have readership data and thus reported "-1", which further replaced "0" for subjecting to the Spearman correlation. The correlation was applied using the Jamovi software. The query used for searching LIS articles on WoS was as follows:
Mendeley Readership Characteristics of Library and Information Science Articles | Vysakh, & Ramya

(WC= (INFORMATION SCIENCE AND LIBRARY SCIENCE)) AND Language: (English) AND Document Types: (Article)


Results

Summary statistics of the samples collected

Table 1 shows the year-wise statistics of the samples selected for the investigation. A total of 18969 articles, including 2800 from 2010, 3083 from 2011, 3024 from 2012, 2989 from 2013, 3370 from 2014 and 3703 from 2015 were considered for the study. Of these, 16796 (88.54%) articles had DOI and the remaining 2173 (11.45%) articles did not have proper DOI. Out of 18969 articles, 17758 (93.61%) articles had citations from WoS core collection, and the remaining 1211 (6.38%) articles did not find any citations. The Mendeley extraction was carried out by searching for the DOI of the articles in the software and 8370 (44.12%) articles were found to have a readership and 10599 (55.87%) reported having no bookmarks on Mendeley.

<table>
<thead>
<tr>
<th>Year</th>
<th>No of articles</th>
<th>With DOI</th>
<th>Without DOI</th>
<th>With WoS citations</th>
<th>Without WoS citations</th>
<th>With readership</th>
<th>Without readership</th>
</tr>
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<td>2010</td>
<td>2800</td>
<td>2385</td>
<td>415</td>
<td>2554</td>
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<td></td>
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<td>(14.20%)</td>
<td>(19.10%)</td>
<td>(14.38%)</td>
<td>(20.31%)</td>
<td>(14.53%)</td>
<td>(14.94%)</td>
</tr>
<tr>
<td>2011</td>
<td>3083</td>
<td>2631</td>
<td>452</td>
<td>2850</td>
<td>233</td>
<td>1329</td>
<td>1754</td>
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<tr>
<td></td>
<td>(16.25%)</td>
<td>(15.66%)</td>
<td>(20.80%)</td>
<td>(16.05%)</td>
<td>(19.24%)</td>
<td>(15.88%)</td>
<td>(16.55%)</td>
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<tr>
<td>2012</td>
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<td>2690</td>
<td>334</td>
<td>2875</td>
<td>149</td>
<td>1315</td>
<td>1709</td>
</tr>
<tr>
<td></td>
<td>(15.94%)</td>
<td>(16.02%)</td>
<td>(15.37%)</td>
<td>(16.19%)</td>
<td>(12.30%)</td>
<td>(15.71%)</td>
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<td>2013</td>
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<td>(15.76%)</td>
<td>(16.52%)</td>
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<td>(16.83%)</td>
<td>(0.00%)</td>
<td>(16.45%)</td>
<td>(15.21%)</td>
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<td>347</td>
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<td>1859</td>
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<td>(18.00%)</td>
<td>(15.97%)</td>
<td>(17.49%)</td>
<td>(21.80%)</td>
<td>(18.05%)</td>
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<tr>
<td>2015</td>
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<td>3384</td>
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<td></td>
<td>(19.52%)</td>
<td>(19.61%)</td>
<td>(18.87%)</td>
<td>(19.06%)</td>
<td>(26.34%)</td>
<td>(19.38%)</td>
<td>(19.63%)</td>
</tr>
<tr>
<td>Total</td>
<td>18969</td>
<td>16796</td>
<td>2173</td>
<td>17758</td>
<td>1211</td>
<td>8370</td>
<td>10599</td>
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<td>(100%)</td>
<td>(100%)</td>
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</tbody>
</table>

Year-wise growth of Mendeley readers and citations

Figure 1 shows that the Mendeley readers for the LIS articles were escalating year to year until 2014 and further recorded a downward trend in 2015. 2010 recorded a total of 94845 readers for 2800 articles with 2554 citations from WoS. The following year, a total of 107112 readers
bookmarked 3083 articles. A surge was recorded in the number of readers and citations in 2012 with 23384 extra readers and 25 citations for 3024 pieces. Although 2013 logged a little down in the number of articles, the number of readers (162451) and citations (2989) was high compared to the previous year. The year 2014 clocked the highest number of readers with 190308 readers for 3370 articles with 3106 citations. The highest number of citations (3384) were recorded in the last year for a total of 3703 papers with 3384 total readers.

![Year-wise growth of Mendeley readers and citations](image)

**Figure 1. Year-wise growth of Mendeley readers and citations**

**Occupation-wise readers of LIS articles on Mendeley**

Mendeley lets the users select the occupation while registering on the platform; all the information is self-reported by the registrants. Figure 2 shows that nine categories were reported to be read LIS papers after merging Ph.D. students with doctoral students and Postgraduate with Master (RQ1). Mendeley also said the category "other "and unidentified accounts were treated as "Unspecified" since it was not mandatory to mention the occupation while registering. As per Figure 2, the most read category was PhD or doctoral students with 147217 readers, followed by postgraduate/master's students with 112597 (24.02%) readers. The next highest were researchers with 49617(10.58%) readers, followed by bachelor students (37349 or 7.97%) and librarians (34452 or 7.35%). Among the category of faculties, associate professors (24379 or 5.20%) reported reading LIS articles on Mendeley more than professors (22059 or 4.70%), lecturers (16875 or 3.60%) and senior lecturers (6615 or 1.41%).
Figure 2. Occupation-wise readers of LIS articles on Mendeley

**Discipline-wise readers of LIS articles on Mendeley**

Figure 3 depicts the discipline–wise readers of the LIS articles on Mendeley (RQ2). Readers from 16 different disciplines were reported, and the top 10 domains were presented according to the highest number of readers. Readers from Computer Science were the highest users of the LIS articles with 99001 readers followed by readers from Engineering (88210) and Physics & Astronomy (25535). The tiniest reported readers were from Agricultural and Biological Sciences with 14472 readers. The rest of the disciplines with readers were Nursing and Health Professions with 24925 readers, Social Science with 24009 readers, Business, Management and Accounting with 22162 readers, Design with 20972 readers and Linguistics with 19965 readers.

Figure 3. Discipline-wise readers of LIS articles on Mendeley
Country-wise readers of LIS articles on Mendeley

Readers from 107 countries across the globe reported to be the readers of LIS articles on Mendeley and the top 10 countries are shown in Figure 4 (RQ3). According to the Figure, the highest readership was recorded in the United States with 8442 readers, followed by Malaysia with 1809, Brazil with 1720 readers, Portugal with 1605 readers, Italy with 1476 readers, Germany with 1314 readers, New Zealand with 1293 readers, Belgium with 1218 readers, Australia with 997 readers and Finland with 963 readers. The smallest number of readers for the articles were from Lebanon, with two readers; surprisingly, no readers were logged from India.

Figure 4. Country-wise readers of LIS articles on Mendeley

Correlation between Mendeley readership and WoS citations

The result of the Spearman correlation between citations and readership for the LIS articles demonstrates year-wise from 2010 to 2015 in Figure 5 and Table 2. For all the years, citations were positively associated with readership, and the association was statistically significant (P-value <.001). The associations between readership and citation were weak for all the years, and the highest association was observed in 2013 with a rho of 0.383 (rho=0.383, p<.001). The year-wise correlation was as follows, in 2010 rho=0.206, P-value <.001, in 2011 rho =0.196, P-value <.001, in 2012 rho = 0.155, P-value <.001, in 2013 rho=0.383, P-value <.001, in 2014 rho= 0.208, P-value <.001, in 2015 rho= 0.235, P-value <.001) (See Table 2).
### Discussion and Conclusion

The study assessed the Mendeley readership characteristics of the 16796 LIS articles indexed in WoS from 2010 to 2015. Mendeley readership by occupation-wise, discipline-wise and geography-wise was carried out. The study found that Mendeley's readership was much higher than its citations for every year, justifying that readership data could be an early indicator of the research output since readership happens more than citations. The phenomena could be because the authors might have read the articles but did not cite them (Thelwall, 2017). The older the article, the fewer the readers and the trends continued till 2014. The number of articles with Mendeley readership was less than its citations (Figure 1). The occupation-wise analysis of the data showed that PhD/Doctoral students were the top readers of LIS articles since doctoral students use more references for their research work and search for articles comprehensively compared to other categories as evident from a previous study (Larivière et al., 2013). The study corroborated the findings of Maleki (2015) and Nawaz et al. (2023) that doctoral students were the primary users of scientific papers on Mendeley. Mendeley must make it mandatory to specify the occupation of the registrants since the current study reported the highest readership from the category of "Unspecified". So,
whether or not the article was helpful in a particular community can be sought if it makes it compulsory to specify. The discipline-wise results delineated those readers from Computer Science were the top engaged readers. Zahedi and Van Eck (2018) reported that computer science articles were the least registered on Mendeley and why this discipline has a specific intention to read LIS articles is to be explored. It is also visible that the interest in reading library science articles has been spread across 16 different disciplines.

Similarly, the country-wise readership results showed that 107 countries across the globe read LIS articles. The United States emerged as the top country with the highest number of readers, which aligns with the findings of Nath et al. (2020) and Eldakar (2019). The association between readership and citations was low throughout the investigated periods. The year 2013 reported a higher association where all the articles got at least 1 citation, and readership showed a similar impact on citation counts (Figure 5). Consistent with the present study findings, previously published studies also reported a positive association between citations and readership (Parabhoi & Verma, 2020; Zahedi & Haustein, 2018; Thelwall, 2019).

So, concerning research question 4 (RQ4), it is understood that the association between readership and citations did not become strong in the long term. Even though the association between these two metrics is positive, Mendeley can be a proxy for the impact measurement and the classic citations. The possibility of using Mendeley readership for measuring the early impact of LIS research output is visible since readership is more prevalent than citations. Therefore, these findings embark on the possibility of using Mendeley metrics for large-scale scientometric studies. The publishers can also display Mendeley metrics and the citation for their published articles to show the early impact. Future studies can be conducted in other domains to determine Mendeley readership's potential value for measuring the scientific output's premature impact.

The data provided by Mendeley is self-reported by the registrants, and most fields are not mandatory to fill up, like occupation and location details. Adding to this, Mendeley may or may not update the further information exemplifying a 'Master student' who might have become a 'Researcher' or 'doctoral' student. Moreover, the Webometric Analyst could not extract data for some articles.

**Author Contributions**

Vysakh Chingath and A. V. Ramya: conceived and designed the study, reviewed the literature, collected the data, analysis, and graphs, contributed to interpretation and manuscript preparation, literature review, writing manuscript, and proofreading. All authors have read and agreed to the published version of the manuscript.
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Conflict of interest
The authors declare no conflict of interest.

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