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Comparison of Citation Tracking in Google Scholar, Scopus and Web of Science: A Case Study of Panjab University, Chandigarh

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ABSTRACT

The study is a comparative analysis of citation data from three databases-Web of Science, Scopus, and Google Scholar-pertaining to 597 publications authored by academics from six selected teaching departments within the Faculty of Science at Panjab University, Chandigarh. The objective was to identify the most comprehensive individual or combination of databases for citation-based studies. The methodology included extraction of citation data for 597 publications from the three databases, limited to citing publications published up to 2022. These were analysed for overlap, exclusivity, and the proportion of total citations covered by each database, both individually and in cross-database comparisons. Additionally, by merging citation sets from individual databases, the study also explored the potential benefits of using multiple databases in combination. The findings indicate that Google Scholar is the most comprehensive database, followed by Scopus and Web of Science. Furthermore, the study found that combining all three databases yields the most extensive citation coverage and provides a broader picture of a publication's impact and reach in the academic community.

Keywords: Citation databases; Web of science; Scopus; Google scholar; Bibliographic databases

1. INTRODUCTION

Citation databases are indispensable resources for the academic and research communities, facilitating the assessment of research impact[1]. These databases provide publication metadata alongside citation metrics[2]. The inception of citation databases can be traced to the establishment of Science Citation Index in 1964 by Eugene Garfield. The index evolved over the years, incorporating additional indexes such as Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (A&HCI), and the Conference Proceedings Citation Index, among others, eventually culminating in the web-based product known as Web of Science (WoS) in 1997[3]. Concurrently, numerous discipline-specific citation databases emerged, including Chemical Abstracts (Chemistry), MathSciNet (Mathematics), PubMed Central (Health Sciences), CiteSeer (Computer and Information Science), Library, Information Science & Technology Abstracts (LISTA), and PsycINFO (Psychology), among others[4,5]. Despite the emergence of these subject-specific databases, Web of Science maintained a monopoly as a comprehensive multidisciplinary citation database. This monopoly was challenged in 2004 with the introduction of two additional similar products: Scopus by Elsevier and Google Scholar (GS) by Google Inc. These products also offer multidisciplinary coverage comparable to Web of Science. Since their inception, Scopus and Google Scholar have undergone continuous development and expanded their coverage[6]. Web of Science and Scopus are subscription-based databases with a defined list of indexed sources. In contrast, Google Scholar employs robust web crawlers to incorporate any content on the web that ostensibly possesses an academic nature. This unrestricted approach has rendered Google Scholar the largest estimated source of citations[7-9].

The variation in coverage, differences in indexing policies and procedures, along with the ever-increasing number of scholarly publications, has led to numerous comparative studies examining the coverage and citations of these data sources following the introduction of Scopus and Google Scholar. However, no such comparative study has been identified that involves a comparison of these databases from the perspective of academics and publications originating from India. This study seeks to evaluate the utility of these three databases in assessing the research publication impact of academics at Indian universities, with a specific case study focusing on the publications of academics from selected departments at Panjab University, Chandigarh (India).

2. LITERATURE REVIEW

Numerous studies have been conducted to compare the three databases following the emergence of Scopus and Google Scholar. Some of the studies which compare

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all the three databases simultaneously were predominantly focused on the citation analysis of journal articles or academic publications within specific disciplines. For instance, Bauer & Bakkalbasi[10] compared the citations of articles published in Journal of the American Society for Information Science and Technology (JASIST) for the year 1985 and 2000; Bakkalbasi et al.[11] examined eleven journals in oncology and condensed matter physics; Levine-Clark and Gil[12] analysed fifteen business and economics journals; Kulkarni[13], *et al.* studied three hundred twenty eight articles published in JAMA, Lancet, or the New England Journal of Medicine; Jacimovic[14], *et al.* focused on the Serbian Dental Journal; van Aalst[15] considered four hundred and one journal articles published by one hundred and twelve accomplished scholars from various subfields of education during 2000-2007; Lasda Bergman[16] investigated the top five journals in Social Work; Roales-Nieto and O'Neill[17] analysed articles published in the International Journal of Psychology & Psychological Therapy (IJP & PT) between 2001-2010; S. Adriaanse and Rensleigh[18] examined South African environmental sciences journals from 2004-2008; Rahimi and Chandrakumar[19] studied articles from twenty three Open Access ISI-indexed journals within the field of General and Internal Medical Science published in 2007; Chapman and Ellinger[20] analysed all articles from volume 28, 2010 of the Journal of Operations Management; Yang and Meho[21] focused on two academicians from the School of Library and Information Science at Indiana University; Meho and Yang[4] explored the impact of Scopus and Google Scholar on results from Web of Science for all fifteen faculty members of the School of Library and Information Science at Indiana University-Bloomington; Jacso[22] examined the h-index for FW Lancaster; Bar-Ilan[23] examined the citations of the book ''Introduction to Informetrics'' by Leo Egghe and Ronald Rousseau; De Groote and Raszewski[24] analysed publications of thirty College of Nursing faculty members; and Minasny[25], *et al.* studied publications from three hundred forty soil researchers worldwide.

Very few studies were found involving multiple disciplines such as Li[26], *et. al.*[26] compared the citations for all the publications of a journal each in the field of General Medicine, Basic medical Sciences and Nursing for the year 1999; Harzing & Alakangas[27] studied on publications of one hundred forty-six senior academics of University of Melbourne, Australia, belonging to five broad subject areas, Humanities, Social Silences, Engineering, Sciences and Life Sciences; Martín-Martín[28-29], *et. al.* in two separate articles studied two thousand five hundred and fifteen highly-cited documents across two hundred fifty-two subject categories.

These diverse studies, although focused on different subject areas and objectives, exhibit certain commonalities. A predominant aim among these studies was to identify a comprehensive source of citation data. The majority concluded that Web of Science (WoS) and Scopus offer limited coverage, resulting in fewer citations, whereas Google Scholar provides the most extensive coverage and citations. However, the lack of transparency in indexing policies, the absence of facilities for aggregating large citation datasets, and the inclusion of non-scholarly content render Google Scholar unsuitable for exclusive reliance.

Another significant observation from these studies was that research impact may be undervalued or overvalued depending on the subject areas, the database used, and the timing of the study. This variation is attributed to differences in the coverage of these sources[11,13,21, 23,27,29] Most of these studies suggested to use a combination of these three databases due to the differences in their coverage.

The literature review reveals that the emergence of Scopus and Google Scholar as competitors to the previously monopolistic Web of Science has initiated discussions concerning the comparative coverage and comprehensiveness of these databases as sources for citation-based evaluative studies. Although numerous studies have been conducted from various perspectives, no research has been identified that specifically addresses the publications of Indian academics. This study is perhaps the first step towards a more informed selection of databases for citation-based studies involving evaluation of publications by Indian academics.

3. OBJECTIVES

This study aims to present a comparative analysis of the three databases from the perspective of research evaluation concerning the publications of Indian academics. The objectives of the study included:

- To identify most suitable individual database or combination of databases for literature search in Pure Sciences and measuring the impact of publications under the study;
- To assess the percentage of overlapping and exclusive citations provided by three databases for the publications under the study;
- To measure the total citations retrieved by the three databases together and the proportion covered by them individually;
- To measure how extensively each database overlaps citations across other two databases;

4. METHODOLOGY

4.1 Sample

The current study included a selection of 597 publications from six departments dedicated to pure sciences within the 'Faculty of Science' at Panjab University, Chandigarh. These publications were extracted from the university's annual reports for the academic years 2016-17, 2017-18, and 2018-19, which can be accessed at https://iqac.pu.ac.in/annual-reports/. The department wise detail of publications selected is shown in the Table 1.

Table 1. Publications covered under the study

S. No.	Department	Number of publications
1.	Department of physics	98
2.	Department of chemistry	332
3.	Department of mathematics	30
4.	Department of botany	36
5.	Department of zoology	48
6.	Department of microbiology	53
	All departments	597

Table 1 above shows the department wise publications selected for the study. The publications reported by the selected departments in the annual reports of Panjab University were thoroughly examined for their inclusion, and those publications that were covered in all three databases were selected.

4.2 Data Collection

Citations for all 597 publications were meticulously obtained from three citation databases (Google Scholar, Scopus and Web of Science) in BibTeX format, during the period from March 2024 to June 2024. This process was conducted for citing publications up to 2022, utilising the limiters available on each database's interface. The citations for individual publications were converted to APA citation style using the 'Online BibTeX Converter' (https://asouqi.github.io/bibtex-converter/) and were manually analysed using MS Word's "Find (Ctrl + F)" function to identify duplicate citations (particularly from Google Scholar) and to categorize them under exclusive and overlapping citation categories for analysis. Each citation was labeled according to the categorisation in Table 2. The most challenging aspect of data collection was from Google Scholar, as it does not offer a direct option to download citations for a publication. Instead, citations must be saved under a label in "My Library" and then downloaded in BibTeX format. Moreover, Google Scholar retrieved duplicate citations, and a few citations were in languages other than English, which were translated to English using the 'Google Translate' facility. The manual process of labeling each citation was time-consuming but ensured the elimination of duplicate citations (found in Google Scholar) and the reliability of the data for the study. The data was further consolidated in accordance with the study's objectives.

4.3 Limitations

The study was limited to the publications reported for three academic sessions (i.e., 2016-17, 2017-18 and 2018-19) covered in all the three databases. As the citation data from the sources is dynamic, the data collection was limited for citing publications up to 2022 using limiters on the interface of each database.

5. DATA ANALYSIS & INTERPRETATION

The data was obtained according to the research methodology above and was analysed according to the objectives. The results have been presented in the following subsections:

5.1 Exclusive and Overlapping Citations

The data for overlapping and exclusive citations among the three databases is presented in Table 2 below:

Table 2 indicates that overall, the majority of citations (63.21 %) were common across the three databases. In contrast, the overlapping citations between Google Scholar and Scopus (9.86 %), Google Scholar and Web of Science (3.54 %), and Scopus and Web of Science (2.38 %) were considerably lower. Google Scholar accounted for the highest percentage of exclusive citations

Table 2. Overlapping & exclusive citations

S. No.	Department	Overlapping citations (GS+Scopus +WoS)	Overlapping citations (GS+ Scopus)	Overlapping citations (GS+WoS)	Overlapping citations (Scopus+WoS)	Exclusive citations (WoS)	Exclusive citations (Scopus)	Exclusive citations (GS)	Total
1.	Department of Physics	1260 (57.03)	276 (12.49)	129 (5.83)	65 (2.94)	50 (2.26)	51 (2.31)	378 (17.11)	2209 (100)
2.	Department of Chemistry	5384 (70.19)	588 (7.66)	162 (2.11)	223 (2.91)	61 (0.79)	250 (3.25)	1002 (13.06)	7670 (100)
3.	Department of Mathematics	250 (60.97)	45 (10.97)	4 (0.97)	9 (2.19)	3 (0.73)	8 (1.95)	91 (22.19)	410 (100)
4.	Department of Botany	743 (47.68)	240 (15.4)	25 (1.61)	16 (1.02)	7 (0.44)	103 (6.61)	424 (27.21)	1558 (100)
5.	Department of Zoology	382 (57.18)	73 (10.92)	16 (2.39)	8 (1.19)	11 (1.64)	17 (2.54)	161 (24.1)	668 (100)
6.	Department of Microbiology	815 (55.82)	156 (10.68)	19 (1.3)	12 (0.82)	8 (0.54)	74 (5.06)	376 (25.75)	1460 (100)
	Total	**8834 (63.21)**	**1378 (9.86)**	**355 (2.54)**	**333 (2.38)**	**140 (1.01)**	**503 (3.59)**	**2432 (17.40)**	**13975 (100)**

Note: Percentage in parenthesis

(17.40 %), followed by Scopus (3.59 %) and Web of Science (1.01 %). The predominance of overlapping citations among the three databases suggests a high degree of similarity in their coverage, yet the notable proportion of exclusive citations points to minor differences.

Similarly, across various departments, the majority of citations (over 50 %) were overlapping among the three databases, with the Department of Botany being a notable exception, where the figure was less than half (47.68 %). The highest percentage of overlap among all three databases was recorded for citations from the Department of Chemistry (70.19 %), followed by the Department of Mathematics (60.97 %) and Department of Zoology (57.18 %). The lowest percentage of overlap was observed for citations from the Department of Botany (47.68 %), followed by the Department of Microbiology (55.82 %) and the Department of Physics (57.03 %). A significantly lower percentage of overlap between pairs of databases was observed across departments. The overlap between Google Scholar and Scopus ranged from a minimum of 7.66 % for the Department of Chemistry to a maximum of 15.4 % for the Department of Botany. The overlap between Google Scholar and Web of Science ranged from 0.97 % for the Department of Mathematics to 5.83 % for the Department of Physics, while the overlap between Web of Science and Scopus ranged from a minimum of 0.82 % for the Department of Microbiology to a maximum of 2.94 % for the Department of Physics.

Notably, the percentage of exclusive citations obtained by Google Scholar was highest for the Department of Botany (27.21 %), followed by the Department of Microbiology (25.75 %) and the Department of Zoology (24.1%). The lowest percentage was observed for the Department of Chemistry (13.06 %), followed by the Department of Physics (17.11 %) and the Department of Mathematics (22.19 %). The exclusive citations obtained by Scopus and Web of Science were comparatively lower. Scopus recorded the highest percentage of exclusive citations for the Department of Botany (6.61 %), followed by the Department of Microbiology (5.06 %) and the Department of Chemistry (3.25 %), while the lowest percentage was found for the Department of Mathematics (1.95 %), followed by the Department of Physics (2.31 %) and the Department of Zoology (2.54 %). Web of Science recorded the highest percentage of exclusive citations for the Department of Physics (2.26 %), followed by the Department of Zoology (1.64 %) and the Department of Chemistry (0.79 %), while the lowest percentage was for the Department of Botany (0.44 %), followed by the Department of Microbiology (0.54 %) and the Department of Mathematics (0.73 %).

The findings suggest a high degree of similarity in the citation coverage provided by the three databases for publications by academics from departments related to Pure Sciences at Panjab University, Chandigarh. However, the substantial number of exclusive citations identified by each database indicates significant differences in their coverage. The variations across departments for overlapping and exclusive citations provide an insight into the variations in coverage of citations for individual subject areas.

5.2 Proportion of Citations

The total number of citations was obtained for by aggregating both overlapping and exclusive citations,

S.No.	Department	Web of Science	Scopus	Google Scholar
1	Department of physics	68.08 %	74.78 %	92.48 %
2	Department of chemistry	76.01 %	84.02 %	93.03 %
3	Department of Mathematics	64.87 %	76.09 %	95.12 %
4	Department of Botany	50.77 %	70.73 %	91.91 %
5	Department of Zoology	62.42 %	71.85 %	94.61 %
6	Department of Microbiology	62.51 %	72.39 %	93.56 %
	All departments	69.13 %	79.05 %	93.01 %

Figure 1. Proportion of total citations covered by individual database.

as presented in Table 1. Subsequently, the proportion of citations for each individual database was calculated by summing their respective overlapping and exclusive citations. Fig. 1 below illustrates the proportion of total citations acquired by each database individually.

Figure 1 indicates that Google Scholar incorporates the highest proportion of citations overall, (93.01 %), followed by Scopus (79.05 %) and Web of Science (69.13 %). Similarly, across various departments, Google Scholar consistently covers the largest proportion of citations, (91.91 % to 95.12 %), followed by Scopus (70.73 % to 84.02 %), and Web of Science, (50.77 % to 76.01 %). Within specific departments, Google Scholar achieves the highest citation coverage for the Department of Mathematics (95.12%), followed by the Department of Zoology (94.61 %) and the Department of Microbiology (93.56 %). Conversely, the lowest coverage by Google Scholar is observed in the Department of Botany (91.91 %), followed by the Department of Physics (92.48 %) and the Department of Chemistry (93.03 %). Scopus exhibits the highest citation coverage for the Department of Chemistry (84.02 %), followed by the Department of Mathematics (76.09 %) and the Department of Physics (74.78 %). The lowest coverage by Scopus is noted in the Department of Botany (70.73 %), followed by the Department of Zoology (71.85 %) and the Department of Microbiology (72.39 %). Web of Science covers the highest proportion of citations for the Department of Chemistry (76.01 %), followed by the Department of Physics (68.08 %) and the Department of Mathematics (64.87 %). However, the lowest citation coverage by Web of Science is found in the Department of Botany (50.77 %), followed by the Department of Zoology (62.42 %) and the Department of Microbiology (62.51 %).

The results suggest that Google Scholar is the most comprehensive among the three databases examined, encompassing over 90 % of citations both overall and across various departments for publications by academics in disciplines related to pure science at Panjab University, Chandigarh. In contrast, Scopus, followed by Web of Science, demonstrated comparatively lower coverage.

5.3 Citation Overlap Across Databases

Citations overlap across the databases were calculated for the publications of each department. The results have been shown in Fig. 2 below.

Figure 2 reveals that overall Google Scholar covered 95.11 % citations of Web of Science and 92.43 % of Scopus, whereas they covered 70.52 % & 75.55 % of Google Scholar citations, respectively. Similarly, Scopus covered 94.87 % citations of Web of Science, while Web of Science covered 82.97 % citations of Scopus. Similar trends were found across the departments. Google Scholar covered 92.35 % to 97.65 % of citations found in Web of

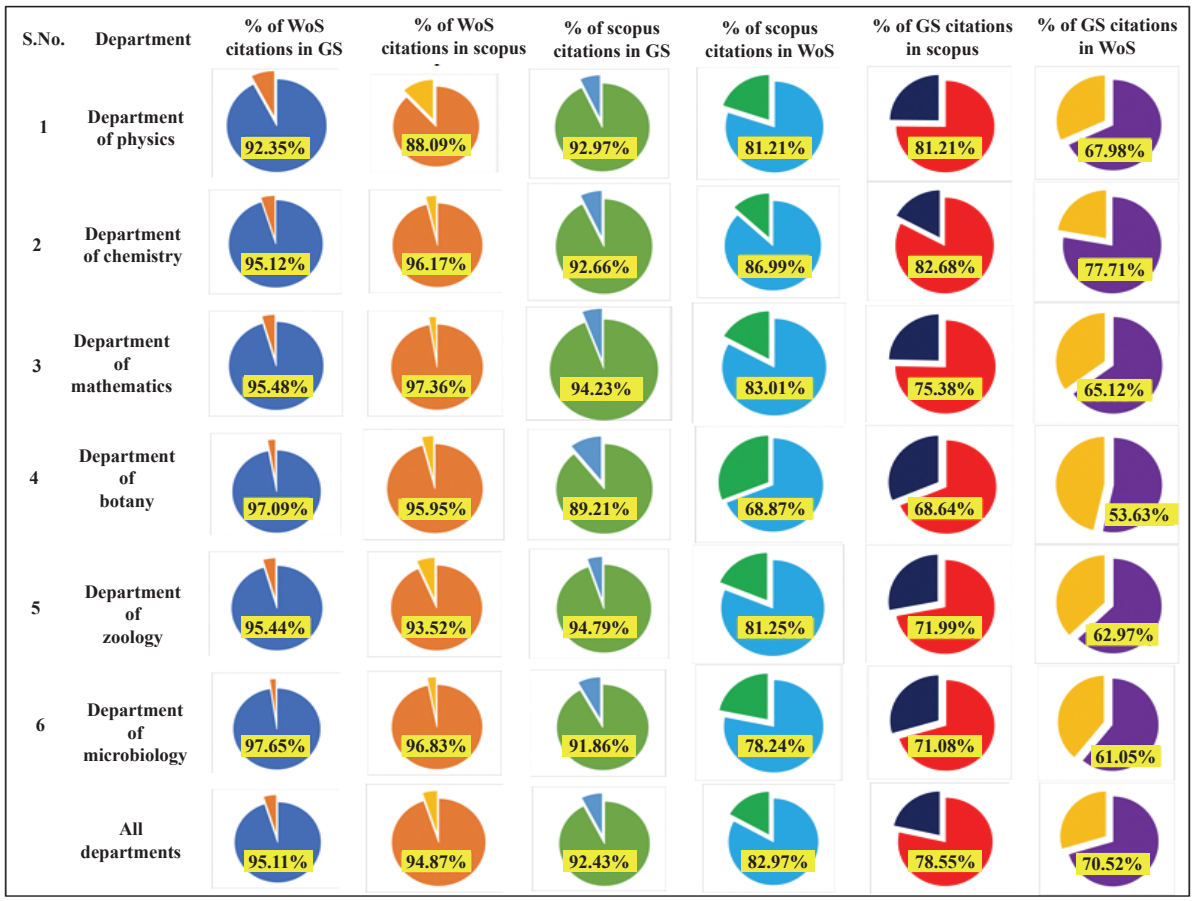

Figure 2. Citation overlap across databases.

Science as well as 89.21 % to 94.79 % citations of Scopus, whereas they covered 53.63 % to 77.71 % and 68.64 % to 82.68 % of Google Scholar citations, respectively. Scopus covered 88.09 % to 97.36 % citations of Web of Science, while Web of Science covered 68.87 % to 86.99 % citations of Scopus.

The results suggest that Google Scholar has the most comprehensive coverage of citations among the three followed by Scopus and Web of Science. Moreover, Google Scholar being freely available has an additional advantage to individuals and institutions across India which do not have the paid access to Scopus and Web of Science.

5.4 Combination of Databases

The analysis of exclusive and overlapping citations reveals that Google Scholar offers the most extensive coverage of citations. It encompasses the highest proportion of total citations and include over 90 % of the citations provided by Scopus and Web of Science. Table 3 below presents the results of combining Google Scholar citations with those from other databases to determine the most effective combination for evaluating the impact of publications from selected teaching departments of Panjab University, Chandigarh.

Table 3 indicates a gradual increase in citation counts in comparison to the citations recorded by Google Scholar. This increase is consistent across various departments, with the most significant rise observed when all three databases are combined, followed by the combination of Scopus and Google Scholar, and then the combination of Web of Science and Google Scholar. Overall, 7.51 % increase was noted for the combination of all three databases, 6.43 % increase for the combination of Scopus and Google Scholar, and 3.63 % increase for the combination of Web of Science and Google Scholar. Among the departments, the Department of Botany experienced the maximum increase in citation counts (GS + WoS = 1.6 %, GS + Scopus = 8.3 %, and all databases =8.79 %). In contrast, the Department of Mathematics exhibited the minimum increase (GS + WoS = 3.7 %, GS + Scopus=4.35 %, and all databases= 5.12 %). The noteworthy observation was that overall and across the departments the difference in increase in citations with the combination of Google Scholar and Scopus in comparison to all the three databases was insignificant (around 1 % or less) except for the department of Physics (2.45 %).

The findings indicate that there are significant disparities in the citation coverage of publications by academics from Panjab University, Chandigarh, across the three databases examined. To achieve a more comprehensive understanding of the impact of these publications, a combination of these databases or Combination of Scopus and Google Scholar shall be a better preposition.

6. DISCUSSION

The research results demonstrate that when comparing three databases for citations of publications by Indian academicians in the field of pure sciences from Panjab University, Chandigarh, there are both differences and similarities with previous related studies. The percentages of overlapping citations among the three databases, as shown in Table 2, are much higher than those reported in earlier studies by Bakkalbasi[11], *et al.*; Jacimovic[14], *et al.* and Rahimi and Chandrakumar[19]. However, direct comparisons with these studies may be limited due to differences in micro subject areas, study periods, and the evolving nature of the databases. However, these numbers, (although higher), are more in line with those reported by Martín-Martín[28], *et al.* which were 54.5 % for Physics & Mathematics, 56.7 % for Life Sciences, and 67.7 % for Chemical and Material Sciences, thus indicating the

Table 3. Effect of combination of databases on citation count

S. No.	Department	No. of citations (GS)	Combination of (WoS + GS) (Increase in percentage)	Combination of (Scopus + GS) (Increase in percentage)	Combination of (WoS + Scopus + GS) (Increase in percentage)
1.	Department of physics	2043	2158 (+5.62)	2159 (+5.67)	2209 (+8.12)
2.	Department of chemistry	7136	7420 (+3.97)	7609 (+6.62)	7670 (+7.48)
3.	Department of mathematics	390	402 (+3.07)	407 (+4.35)	410 (+5.12)
4.	Department of botany	1432	1455 (+1.6)	1551 (+8.31)	1558 (+8.79)
5.	Department of zoology	632	651 (+3.06)	657 (+3.95)	668 (+5.69)
6	Department of microbiology	1366	1386 (+1.46)	1452 (+6.29)	1460 (+6.88)
	All departments	12999	13472 (+3.63)	13835 (+6.43)	13975 (+7.51)

continuous growth in coverage for Google Scholar and Scopus for the disciplines under study. The findings that Google Scholar provides the highest percentage of exclusive citations (followed by Scopus and Web of Science) are consistent with the majority of earlier studies. Regarding the proportion of total citations coverage by individual database (Fig. 1), the current study's results (Google Scholar covers highest percentage followed by Scopus and Web of Science) align with similar investigations by Moed[6], *et al.*; Martín-Martín[28-29], *et al.* The results of our study substantiate the findings by Martín-Martín et. al.[28-29] that Google Scholar encompasses the majority of citations identified in Web of Science and Scopus (Fig. 2) across various academic departments related to Pure Sciences.

Despite Google Scholar being identified as the most comprehensive source of citation data, its limitations regarding cumbersome data extraction, inconsistencies in data quality, lack of standardisation in author names and affiliations, and potential inclusion of non-scholarly sources have been reported in several studies (Bauer & Bakkalbasi[10]; S. Adriaanse and Rensleigh[18]; Martín-Martín[28], *et al.*). These limitations were also observed during data collection for the current study, indicating the continuous lack of intent to improve upon these shortcomings. Despite these drawbacks, the data of the study reflects the value of Google Scholar as a tool for researchers seeking a broad overview of scholarly literature and citation patterns. Furthermore, Google Scholar's free accessibility makes it an attractive option for Indian academicians with limited resources or those working in institutions without subscription to commercial databases. However, for more rigorous bibliometric analyses or institutional evaluations of publications by Indian Academics, (in Pure Sciences) the use of commercial databases especially Scopus may be more appropriate due to its structured data and advanced analytical features and coverage of almost all citations across departments provided by Web of Science.

The combination of databases has been widely recommended by researchers to enhance the comprehensiveness and accuracy of citation-based studies. (Halevi, Moed & Bar-Ilan[30], page 831). This approach addresses the limitations of individual databases and provides a more holistic view of research impact. Our study though corroborates these findings, but also indicate that the gaps in the coverage of Web of Science citations by Scopus and Google Scholar are diminishing, and may be insignificant in some disciplines for publications of Indian academicians. By combining these resources (Table 3), researchers can access additional data that would otherwise be overlooked, enabling a more thorough and nuanced analysis of research impact. Among the possible combinations, findings of the current study indicate that integrating all three databases-Web of Science, Scopus, and Google Scholar-yields the most comprehensive results, followed with a marginal difference by the pair of Scopus and Google Scholar, while Web of Science and Google Scholar yield the least.

7. CONCLUSION

The study clearly substantiates the increasing coverage of Google Scholar and its benefits for providing a broad overview covering and identifying additional resources for free. The study also indicates that Google Scholar has reached such a stage where it covers more than 90 to 95 % of citations obtained by Scopus and Web of Science for the subjects under study. On the other hand, Web of Science and Scopus offer more precise and reliable data for detailed citation-based research. The result of our study clearly confirm that Scopus may be preferred due to the fact that it covers most of the citations (94.87 %) obtained in Web of Science. Though the combination of all the three databases provides the most comprehensive results but the difference between the combination of Google Scholar and Scopus and combination of all the three databases was insignificant (1 % or less) for the current study. The study being limited to academics from select teaching departments from a single institution, may not provide comprehensive parameters to select citation databases as the results may vary in other disciplines and institutions. Moreover, the study included the publications covered in all the three databases, so it may not provide the true picture of coverage of publications published in India. The relevance of the study is in the fact that the citation sources are dynamic in nature and are required to be analysed for suitability for a particular citation-based study or evaluation. Perhaps it is the first study trying to provide insight into the coverage and citation pattern for publications of Indian academics. Given the extensive range of data sources and the substantial volume of publications by Indian academics, the study concentrated on a case study of publications by scholars in the pure sciences from a single institution in India. Further exploration with other disciplines, institutions, and individuals, as well as factors such as database biases and citation inflation etc. may help to further assess the relevance of these sources for various citation-based analyses on publications of Indian academics.

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