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Evaluating the Citations and Social Attention Difference Between Open Access and Paywalled LIS Literature

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ABSTRACT

The purpose of the present study is to assess the open access advantages in getting citations and social media attention for Library and Information Science (LIS) literature indexed in the dimensions database and tracked by Altmetric Explorer. An advanced search in the Altmetric Explorer was carried out to collect the needed data for the study and subjected to parametric and non-parametric tests to achieve the objectives. The results discovered differences in citations and altmetric attention benefits between Open Access (OA) and pay-walled LIS literature. Open access was found to have more citations and altmetrics than Non-Open Access (NOA). Furthermore, green OA outputs were reported to have more citations among the OA categories, while hybrid OA attracted more social media attention. The results of the present study offer insights for authors in deciding where to publish in order to maximise the scientific and social impact of their writings.

Keywords: Open access; Non-open access; Paywall; Social media; Altmetrics; Traditional metrics

1. INTRODUCTION

Altmetrics supplement traditional metrics for research impact evaluation[1]. Open access and altmetrics are complementary and previous studies have justified that OA is an explicit parameter in deciding citations and social media attention[2-4]. For example, it was observed from a previous study that OA literature got 18 % more citations as compared to subscribed contents[5]. Furthermore, social media distribution with OA features enhances the percolation of scientific publications. For instance, are cent study discovered that journals with OA links to their articles garnered more clicks and downloads across the globe than those without OA links or buttons[6]. Another study revealed that OA had doubled the downloads for articles in science, humanities and social sciences[7].

As far as the LIS domainis concerned, only a few are known concerning these open access gains. An investigation held in 2018 revealed that OA outputs have citation benefits over non-open access after seventeen LIS journals were subjected to analysis[8]. However, further research is necessary to validate these findings by analysing a comprehensive range of LIS journals. In addition, among the OA categories, which category enjoys higher citations and altmetric benefits is to be discovered on which no investigation has been carried out so far. So, the present study has been undertaken to fill these gaps.

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2. PAST STUDIES

The advantage of open access in gaining citations and social attention has been propounded by many researchers from several domains[9-11]. In this section, the authors have selected and critically reviewed some of the core articles. Antelman[12], after analysing research outputs from four major domains, including political science, philosophy, mathematics, and electrical and electronic engineering, revealed that OA outputs have a higher citation impact compared to paywalled contents. The percentage difference in citations between OA and NOA was estimated at 86 % for political science, 45 % for philosophy, 91 % for mathematics,and 51 % for electrical and electronic engineering, respectively. Apart from these four disciplines, the OA outputs from the 'law' domain also enjoyed the citation benefit over NOA as per the study findings of Donovan and Watson[13]. Taylor and the easy availability of evidence of online sharing in the form of altmetrics. There has been limited examination of the effect of OA on online sharing for journal articles, and little for books. This paper examines

the altmetrics of a set of 32,222 books (of which 5 % are OA[14] investigated the altmetric attention benefit of the OA books in the humanities and social science domain. 32222 books (OA-5 %) and 220527 chapters (OA-7 %) from humanities and social science disciplines indexed in the Dimensions database were selected and studied. The findings revealed that OA chapters and books found notablyelevated social media platforms use than NOA books and chapters. In addition, OA chapters were reported to have more coverage on Wikipedia than paywalledones and more bookmarking on Mendeley.

Clayson[15], *et al.* reported that OA research outputs in human electrophysiology had 9 to 21 % more Crossref and PubMed citations and 39 % increased altmetric attention. It was 8 % more citations from the Web of Science when a hundred journals in botany, ecology and multi-disciplinary science and biology were assessed[16]. Torres- Salinas[17], *et al.* assessed the uptake of OA to COVID-19 literature and their social media attention benefits over NOA access articles. 11686 articles (67.5 % were OA) from the Dimensions database were subjected to analysis. The study discovered that OA articles received the highest share of social media attention compared to NOA articles. Literature that is free to use has increased its social engagement, especially on mainstream platforms like Twitter, Facebook, blogs and Mendeley as per the study findings of Alhoori[18], *et al* . and Holmberg[19], *et al*. Contrary to all these study findings, Khan[25], *et al.* reported that NOA LIS journals had a citation advantage over OA LIS journals when 116 (58 OA and 58 NOA) LIS journals from the Scimago website were studied. The review of past studies found that research exploring the open-access advantage in getting citations and social media attention for the LIS domainis meagre especially concerned with Dimensions.ai data. So, the present study has been carried out to bridge this gap and is driven by the following three prime objectives.

3. OBJECTIVES OF THE STUDY

- To measure the correlation between citations and altmetric attention score for LIS literature of different access types.
- To assess the difference in getting citations and altmetrics between OA and NOA LIS literature.
- To find out which OA category of LIS literature gets more citations and altmetric scores.

4. METHODOLOGY

4.1 Source of Data

Altmetric Explorer, a web-based platform provided by Altmetric.com, a data science company, was utilised to collect the required data (including citations and altmetric details) for the study. Web citations from the Dimensions. ai database for the queried outputs would be harvested normally along with the social media metrics in the Altmetric Explorer. The search results for LIS output in the Explorer produced the Dimensions Citations (DC) along with Altmetric Attention Score (AAS), i.e. the weighted count of all the attention and its constituent score components. Thus, no separate search or extraction was carried out for collecting the citations.

4.2 Process of Data Collection

The advanced search feature was activated, and the subject category 'Library and Information Studies' with category number '0807' was queried in the respective tab. In addition, a few search refines were applied like outputs in the 'English' language and the period from '1889 to 2022'. The year 1889 was selected as the researcher found LIS articles indexed in the database since 1889. All the checkboxes under the access category were marked as the authors wanted to have citations and altmetric details of all the categories for the subsequent analysis. After setting the refinements, the 'RUN' tab was hit and the search produced 31867 outputs including 31704 articles, 8 books and 155 chapters. Later the result was exported to an Excel file for the ensuing analysis. The entire data collection was completed in the first week of March 2022.

4.3 Method of Analysis

The collected data were subjected to parametric and non-parametric tests and done in Jamovi version 2.3.19. To fulfil the first research objective i.e. to measure the relationship between citations and altmetric score, a Spearman correlation test was applied. Concerning the second objective, i.e. to assess the difference in getting citations and altmetrics between OA and NOA LIS outputs, the Mann-Whitney U test was applied. Later,one-way-ANOVA was applied to find out the citations and altmetrics difference among various OA outputs, viz. gold, green, hybrid and bronze to achieve the third objective.

5. ANALYSIS AND INTERPRETATION

5.1 DC and AAS Gained by Different Access Types

Table 1 shows the number of outputs, DC and AAS gained by different access types. As per the data in the Table, more than half (57.58 %) of the outputs were NOA.The counterpart, i.e. OA, accounted for 42.42 %. Further splitting the OA outputs, gold OA was found to have more in number with 4875 (36.07 %), followed by green (32.58 %), bronze (21.87 %) and hybrid (9.48 %). As far as Dimensions citations are concerned, NOA was found to have more citations (58.58 %) than open access. Secondly, green OA outputs garnered 105246 or 48.77 %, nearly half of the total citations. The lowest citations were bagged by hybrid with 15430 or 7.16 % of total citations. Concerning the attention from social media, it was apparent that OA outputs gained more attention with a total of 100123 or 55.94 % altmetric score. Among the OA, gold outputs were reported to have more social media attention with 32654 or 32.62 % of the altmetric score. Again, hybrid outputs were the least mentioned on social platforms with a 17500 altmetric score, which held 17.48 % of the total altmetric score.

Table 1. DC and AAS for different access types

Type of access	No. of outputs	%	DC	%	AAS	%
Bronze OA	2956	21.87	34063	15.78	19948	19.93
Gold OA	4875	36.07	61069	28.29	32654	32.62
Green OA	4405	32.58	105246	48.77	30021	29.98
Hybrid OA	1282	9.48	15430	7.16	17500	17.48
Total	13518	100	215808	100	100123	100
NOA	18349	57.58	305192	58.58	78857	44.06
Aggregate	31867	100	521000	100	178980	100

5.2 Sources of Altmetric Attention in Detail for Different Access Status

Table 2 shows that 2956 bronze outputs were present on 12 platforms, with higher activities recorded from Mendeley and Twitter with 114251 readership and 20109 Twitter activities. Moreover, outputs in the bronze category did not find any mentions from five key sources, including Weibo, LinkedIn, Pinterest, F1000 and Q & A. The total mentions recorded from bronze outputs accounted for 136588 which is 8.07 % of total mentions. Gold OA was active on fourteen social platforms with an aggregate attention of 219910 (13 %) which is more than that of bronze. Again, Mendeley was the primary carrier of gold outputs with total bookmarks of 187918 (12.43 %). Except for Pinterest, green OA outputs were traceable in all other altmetric platforms. Among the OA categories, green OA got the highest mentions for its 4405 outputs, with elevated mentions recorded from Mendeley (281482), Twitter (26960) and blogs (1042). The lowest mention among the OA outputs was scored by hybrid OA outputs which were yet to be reported on four dominant platforms, including Weibo, LinkedIn, Pinterest and F1000. The total mentions acquired by this access type category was 89895, 5.31 % of the total mentions.

In contrast to OA outputs, NOA outputs (N= 18349) were present on all the platforms and the total mention was higher than that of all the OA outputs. The total mentions bagged by NOA outputs was 932240, which held 55.13 % of the total mentions. For NOA articles, the topmost mentions were clocked from Mendeley, with 56.90 % of the total Mendeley bookmarks. The lowest mentions of NOA outputs were traced from LinkedIn and F1000 with two mentions, respectively.

5.3 Correlation Between DC and AAS As Per Access Types

The Spearman correlations were run between the citations and altmetric score of LIS outputs of different access types separately to know which type attracts more interconnection. As per Figure 1, a higher correlation was found for hybrid OA outputs with a correlation coefficient value of .25 (rho= .25, p< .001) followed by gold OA outputs (rho= .20, p< .001) and bronze OA (rho= .18, p< .001). The correlation was the same for green and NOA outputs with a correlation coefficient of .17 (rho= .17, p< .001).

Table 2. Source of attention in detail for different access types

Sources	Bronze OA (N=2956)	Gold OA (N=4875)	Green OA (N=4405)	Hybrid OA (N=1282)	Non-open access (N=18349)	Total
Number of Mendeley readers	114251	187918	281482	67294	859675	1510620
Twitter mentions	20109	27537	26960	21298	58610	154514
Blog mentions	437	1535	1042	414	2075	5503
Wikipedia mentions	387	476	491	78	2661	4093
Facebook mentions	535	914	462	209	1853	3973
Policy mentions	273	573	624	141	2128	3739
News mentions	432	446	520	362	1860	3620
Patent mentions	38	135	343	5	2649	3170
Google+ mentions	65	286	181	46	275	853
Peer review mentions	23	17	28	5	275	348
Reddit mentions	33	36	45	31	97	242
Video mentions	5	17	11	7	51	91
Q&A mentions	0	8	12	5	14	39
F1000 mentions	0	12	1	0	2	15
Weibo mentions	0	0	2	0	10	12
LinkedIn mentions	0	0	1	0	2	3
Pinterest mentions	0	0	0	0	3	3
Total	**136588**	**219910**	**312205**	**89895**	**932240**	**1690838**

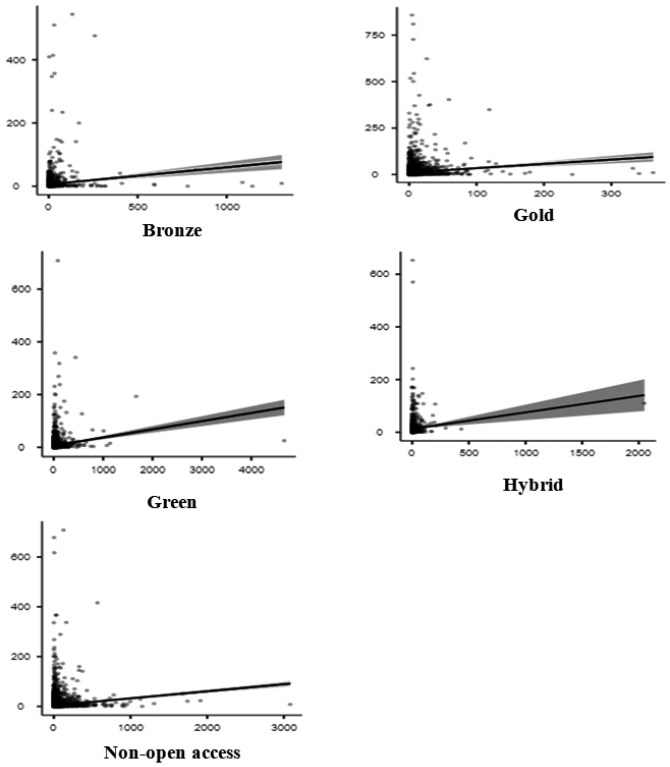

Figure 1. Correlation between DC and AAS as per access types.

5.4 The Difference in Getting Citations and Altmetrics Between OA and NOA LIS Outputs

As per Table 3, citation benefits exist among OA and NOA outputs. Citation benefits in OA (Mdn= 4, Range= 4668) significantly differed from NOA (Mdn= 3, Range= 3084). The difference was (3.76, 95 CI [3.13, - 1.16] U= 1.20, P= .001). This was seen to have a low effect size (r= .03). Altmetrics benefits were also reported among OA and NOA outputs. Altmetrics benefits in OA (Mdn= 3, Range= 708) were significantly different from NOA (Mdn= 2, Range= 708). The difference was (1, 95 CI [1,-1] U= 1.03, P= .001). This was also reported to have a low effect size (r= .16). Thus, it was apparent that OA outputs benefit from more social media attention and citations compared to NOA outputs.

5.5 Citation and Altmetric Difference Among OA Outputs

Table 4 shows a significant difference in getting citations (F= 31.4, P< .001) and altmetric attention (F= 40.2, P< .001) across various OA outputs. Since Levene's test is significant (p< .001), an equal variance was not assumed. To assess the individual difference between groups, post-hoc comparisons using the Games-Howell Post-Hoc Test were applied. As per Table 4a green OA outputs (M= 23.89, SD= 94.4) were significantly different from hybrid (M= 12.04, SD= 62.5), bronze (M= 11.52, SD= 52.7) and gold (M= 12.53, SD= 37) in getting citations. In specific, green OA outputs attracted more citations in Dimensions. In contrast, hybrid outputs (M= 13.65, SD= 33.8) outperformed other output types in attaining social attention.

6. FINDINGS AND DISCUSSION

The present study has been carried out mainly to find an answer to the long-standing question of whether OA accelerates the citations and social media attention for LIS literature. The authors extracted 31867 samples taken from the Dimensions.ai database and tracked by Altmetric.com for the analysis and the findings were very interesting and consistent with many similar studies carried out in the LIS domain previously[26-28].

As per our study findings, NOA was reported to have more citations than OA publications from the Dimensions database and this finding is commensurate with the finding of Khan[25], *et al*. Among the OA, green OA attracted more citations than all other OA outputs. The lowest citations were gained by hybrid publications. Contrary, when the authors analysed the social media attention benefits among the different outputs, it was found that OA outputs gained more attention than the paywalled LIS literature. These findings echo the findings of Torres-Saslinas[17], *et al*. that OA outputs have more social media attention. When the authors tracked the social attention of these outputs from various social platforms, it was discovered that NOA outputs were present on all the platforms as compared to OA outputs. Even

Table 3.The difference in getting citations and altmetrics between OA and NOA LIS outputs

					95 % confidence interval			
		Statistic	P- value	Mean difference	Lower	Upper		Effect size
Dimensions citations	Mann-Whitney U	1.20e+8	<.001	3.76e-5	3.13e-5	1.16e-5	Rank biserial correlation	0.0336
Altermetic attention score	Mann-Whitney U	1.03e+8	<.001	1.000	1.000	1.000	Rank biserial correlation	0.1669

Table 4. One-way ANOVA (Fisher's)

	F-value	Degree of freedom (df1)	Degree of freedom (df2)	p-value
Dimensions citations	31.4	3	13514	<.001
Altermetic attention scorS	40.2	3	13514	<.001

Table 4a. Group descriptives

	OA types	No. of outputs	Mean	Standard deviation	Standard error
Dimensions citations	Green OA	4405	**23.89**	94.4	1.422
	Hybrid OA	1282	12.04	62.5	1.747
	Bronze OA	2956	11.52	52.7	0.969
	Gold OA	4875	12.53	37	0.53
Altermetic attention score	Green OA	4405	6.82	20.2	0.305
	Hybrid OA	1282	**13.65**	33.8	0.944
	Bronze OA	2956	6.75	25.1	0.462
	Gold OA	4875	6.7	14.8	0.212

though, for both open and NOA outputs, Mendeley and Twitter were the most intake sources. So, it can be said that the promotion of scholarly outputs through Twitter is more beneficial for the authors for the maximum social impact, and the growth of Twitter activities for outputs over time is confirmed in a previous study conducted by Taylor[20]. It was also noted that outputs are yet to penetrate various platforms like SinaWeibo, Pinterest, Linkdelen etc. The possible reason could be the discontinuation of collecting mentions from these sources by Altmetric.com as identified from a previous study conducted by Elmore, S.A[21].

The correlation result revealed that both OA and NOA outputs citations were positively correlated with altmetric attention scores. The positive association between altmetrics and citations have been identified for LIS outputs in previous studies also proposing that altmetric score can be supplemental for the classic citation metrics for the quick invisible impact measurement for LIS literature[22-23]. Among the outputs, the altmetric score of hybrid outputs showed similar features as citations as compared to other OA and NOA LIS outputs.

Concerning the second objective i.e. is there any difference in getting citations and altmetrics between OA and NOA LIS literature, the authors found that both citation and social media attention benefits exist among OA and NOA outputs. OA outputs have the perks of attracting more citations and altmetrics than paywalled ones which stood against the result reported in Table 1 when the tests were applied. Furthermore, green OA outputs attracted more citations in Dimensions while hybrid outputs outperformed other output types in attaining social attention. So, it is patent that author/self-archived LIS outputs (Green OA) reported more citations and this finding is consistent with the findings of many previous studies that papers with a preprint attract more citations than papers with no preprint[15,24]. Since hybrid OA LIS outputs gained more mentions from the social platforms, it must be said that paying article processing charges (APCs) by the authors has benefitted them by bringing more social citations to their writings.

7. CONCLUSION

The present study findings advocate that OA LIS outputs have a visible citation and altmetric attention supremacy. These findings may motivate the LIS scholarly community to go for OA publishing and pursue publications outlets that support it. The higher education and research institutions should be more supportive of the LIS authors of providing the necessary costs for making publications OA.Adding to this,they may mandate the researchers for OA self-archiving outputs to achieve maximum pre-publication percolation. It is worth saying that merely making an article free to use does not increase its citation or social impact; at the same time, its quality also matters. Therefore, producing high-quality articles and making them free to read would increase their impact. The potential for OA and altmetrics to grow together can be validated by conducting similar kinds of investigations in different domains in the future.

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His contribution to this paper includes the selection of the topic, data collection, analysis & interpretation and overall drafting of the paper.

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