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A Comparative Analysis of Altmetrics Score and Citation: A case study from Physics

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Abstract

This paper discusses the vivid account of Altmetrics, a new way to measure the impact of scholarly communication. Altmetrics is the newborn child in the field of impact judgment techniques of scholarly communication. The primary purpose of this study is to compare citation (Academic Impact) and 'Altmetric Score' (Social Impact). In this study, Altmetrics details of top-cited ten articles retrieved by ten keywords each in the subject domain of physics from the bibliographic database Web of Science (WOS) are collected to compare the same. This study reveals whether the citation-based and Altmetric-based ranking show a similar pattern or are in consonance with each other.

KEYWORDS: Altmetrics, Altmetrics Score, Web 2.0, Scientometrics, Scholarly Communication

INTRODUCTION

Scholarly communication is the process of academics', scholars' and researchers' sharing their findings so that they are available to the broader community and beyond. Borgman (1989) described scholarly communication as "the study of how scholars in any field use and disseminate information through formal and informal channels. The study of scholarly communication includes the growth of scholarly information, the relationships among research areas and disciplines, information needs and uses of individual user groups, and the relationships among the formal and informal method of communication." The advancement of the internet and the World Wide Web has significantly influenced scholarly communication. The mode of scholarly communication has drastically changed with the introduction of the interactive Web, web 2.0. With web 2.0, scientists have platforms such as blogs, YouTube, and Facebook that enable them to disseminate their studies and views to the broader public and interact and have discussions with the public (Ilan, Shema & Thelwall, 2014). Scientists are increasingly visible on the Web and social media. They are discussing, sharing, and bookmarking scholarly articles online and discussing their research topics in the social forum in large numbers. As scholarly communication disseminates through formal and informal channels, the impact measurements of these processes have been measured in consideration of both formal and informal discussions. In this way, the impact measuring techniques, i.e. the world of metric sciences, have been turned over paradigm shift and are developing incessantly in different subject domains. Besides classical metrics('Bibliometrics', 'Scientometrics', 'Informetrics' etc.), there are several other metrics used today that include social networking effects and open source communication models, for instance, 'wiki metrics', 'open source metrics', 'journal metrics', 'article-level metrics' and the newcomer in the field the 'Altmetrics'.

WHAT IS 'ALTMETRICS'?

Altmetrics is the newborn child in the field of impact judgement techniques of scholarly communication. It was first mentioned by Jason Priem in 2010 as a generalization of article-level metrics and had its roots in the altmetrics hashtag (#) (Priem, 2010). According to Altmetrics Manifesto, Altmetrics is the creation and study of new metrics based on the social Web for analyzing and informing scholarship, which may be considered a sub-discipline of Scientometrics (Dutta, 2015).

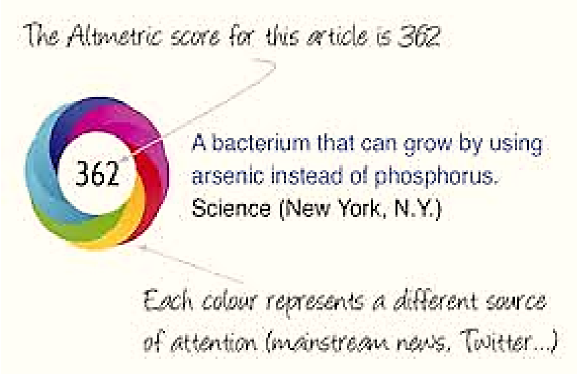
Altmetrics typically looks at individual research outputs, including journal articles or datasets. From a system point of view, Altmetrics is a system that tracks the attention that scholarly articles and datasets receive online. It does this by pulling in data from three primary sources –

1) Social Media like Facebook, Twitter, Blogs, google+ etc.
2) Traditional media like newspapers etc.
3) Online reference managers like Mendeley and CiteULike etc.

ABOUT ALTMETRIC SCORE

Altmetric score is the score mentioned by 'Altmetric.com'- the Altmetric data provider, based on online attention achieved by a scholarly publication. It aggregates all the information that is mentioned in social media related to any scholarly article. It looks at both the quantity and quality of attention paid to an article and visualizes it.

The number inside the coloured circle is the Altmetric score for the article being viewed. This is a quantitative measure of the quality and quantity of attention that the articles have received. The colours themselves reflect where the posts mentioning the article have come. For example, red means that mainstream news outlets have mentioned the article, and blue means it has been tweeted.



(Source:-https://www.altmetric.com)

Two factors influence the Altmetric score

1) The number of posts mentioning an article.
2) The quality of each post

The first one is relatively straightforward; the more posts mention an article, the higher its score. In general higher-profile posts are worth more than lower-profile ones. For example, an article in the Washington Post contributes more, in score terms, than a blog post. A blog post contributes more than a tweet.

BIBLIOMETRICS TO ALTMETRICS: A BRIEF JOURNEY

The world of scholarly communication has been facing some radical changes since the beginning of the 1990s. Paper-based printed communication was gradually sidelined to leave the track for the newcomer electronic-media-based online (offline also) communication. The last decade of the 20th century may be reckoned as the opening gateway to the internet and communication revolution, which added new dimensions to information and knowledge society. The scholarly community in today's knowledge society communicates with each other in a non-traditional way besides the traditional one. The growing pervasiveness of the Web is creating an environment in which scholars and other users create new kinds of tracks that reveal once-invisible scholarly activities. Inexorably, the daily work of scholars, like other knowledge workers, is moving online (Priem, 2014).

In this context, with the arrival of web 2.0 and scientists' gradual use of said platforms as tools for the diffusion and receipt of scientific information and with part of the scientific community relatively receptive, scientometrics 2.0 (Priem& Hemminger, 2010) began to be discussed. Though the word scientometrics 2.0 was coined in 2010, the earlier footstep of this appeared with the term 'Webometrics', coined by Almind and Ingwersen in 1997. 'Webometrics' is defined as "the study of web-based content with primarily quantitative methods for social science research goals using techniques that are not specific to one field of study" (Thelwall, 2009). Another milestone in the era of scientometrics 2.0 is 'Wikimetrics'. The term 'Wikimetrics' is considered as the amalgamation of the terms' wiki and metrics. It facilitates data analysis of Wiki pages, establishing standardized metrics across the movement and improving workflow between data stakeholders. After 'Wikimetrics' next footprint comes with the advent of 'Article-level metrics'. Article-level metrics measure the usage and impact of individual research articles. Traditionally, research usage and impact were evaluated based on bibliometrics or informetrics, which was normally focused on journals, such as the impact factor or immediacy index. Some researcher-level metrics, such as the h-index, g-index or i-10 index, were developed in the last decade. Article-level metrics, unlike journal or author metrics, did not focus on journals or authors but on the individual article. After the Article-level metrics, the child 'Altmetrics' comes in this context. 'Altmetrics' are new metrics proposed as an alternative to the widely used journal impact factor and personal citation indices like the h-index, g-index or i-10 index. The term Altmetrics was coined by Jason Priem in 2010 as a generalization of article-level metrics and is rooted in the twitter #altmetrics hashtag. Although Altmetrics are often thought of as article metrics, they can be applied to people, journals, books, data sets, presentations, videos, source code repositories, web pages, etc. Altmetrics does not cover just citation counts, but also other aspects of the impact of a work, such as how many data and knowledge bases refer to it, article views, download, or mentions in social media and news media. Altmetrics are an inclusive group of metrics, capturing various parts of the impact a paper or work can have.

REVIEW OF RELATED WORKS OF LITERATURE

Though the concept of 'Altmetrics' is a growing child, some work has already been done. The features of Altmetric tools in general (Zhang, 2012) and their validation as a sources of impact assessment has been investigated in some studies. (Li & Thelwall & Giustini, 2012) Studied the strengths, weaknesses and usefulness of two reference management tools for research evaluation. Their findings showed that compared to CiteULike, Mendeley seems to be more promising for future research evaluation. (Wouters & Costas, 2012) Compared features of 16 web-based tools and investigated their potential for impact measurement for actual research evaluation purposes. They concluded that although these new tools are promising for research assessment, due to their current limitations and restrictions, they seem more useful for self-analysis than for systematic impact measurement at different levels of aggregation. Another popular reference manager, Zotero, has received less study (Lucas, 2008). Papers and

Read Cube are newer, smaller reference managers. Connotea and Collab dealt poorly with spam; both have now closed.

Before the curtain raiser of Altmetrics, several studies have been conducted to judge the validity of different types of alternative tools for impact assessment. Lewsion (2002) tracked mass media mentions of scholarly articles, finding little relation between journal citation rates and citedness by major news outlets, suggesting that this is a legitimately distinct form of impact. However, other work shows that these mentions affect citation rates, implying that the two are not entirely unconnected (Kiernan, 2003). Now, Wikipedia is perhaps one of the most exciting leadership projects of the 21st century. Jimmy Wales and Larry Sanger launched Wikipedia on January 15, 2001, and just after fourteen years of beginning i.e. in February 2015, The New York Times reported that Wikipedia is ranked fifth globally among all websites. For much of the world, especially students (Head & Eisenberg, 2010; Schweitzer, 2008), Wikipedia is the first stop for information. Therefore influencing 'wikipedia' means profoundly influencing the world. (Nielsen, 2007) has shown that citations in Wikipedia correlate well with data from the Journal Citation Reports, establishing a relationship between impact on Wikipedia and in more traditional contexts. (Prime et al., 2012) report that around 5% of PLoS articles are cited in Wikipedia and report correlations between 0.1 and 0.4 between normalized Wikipedia citations and traditional citations, depending on the journal. Twitter presents a rich source of data but a difficult one for investigators of scholarly impact. Some scholars heavily use Twitter but non-scholars make up the bulk of Twitter users (Priem, 2014).

For this reason, the near-zero correlation between tweets and citations was found in the PLoS dataset (Priem et al., 2012), suggesting that the high visibility of PLOS attracts many non-scholarly readers. On the other hand, (Eysenbach's, 2012) study found a distinct link between tweeting and citation. Even though this more research is needed, that delineates the identity of Twitter users. As social media are becoming a strong field of scientific discourses, several studies have been conducted with social media to determine the impact of an article. (Shuai, Pepe & Bollen,2012) examined scholars' reactions to the newly submitted preprints in arXiv.org, showing that social media may be an essential factor in determining the scientific impact of an article. Social blogs are very much famous for scientific conversations. In this context, "scholarly blogging" is distinguished from its famous counterpart by the expertise and qualifications of the blogger. While a helpful distinction, this is inevitably an imprecise one. (Prime, 2014). Blogging in the academic field has grown steadily in visibility; academics have blogged their dissertations (Efimova, 2009), and the ranks of academic bloggers contain several fields medalists, Nobel laureates, and other eminent scholars (Nielsen, 2009). Despite that, few altmetrics have been conducted based on scholarly blogging. However, extensive research has shown that blogging shares many characteristics of more formal communication, including a long-tail distribution of cited articles (Groth & Gurney, 2010; Shema & Bar-Ilan, 2011). Although science bloggers can write anonymously, (Shema & Bar-Ilan, 2011) studied that most blogs under their real names. The count of PDF downloads is also considered an essential Altmetric tool, and several studies have been conducted investigating article downloads and their relation to later citations. Several researchers have found that downloads predict or correlate with later citations (Perneger, 2004). (Shuai, Pepe &Bollen, 2012) show that downloads and Twitter citations interact, with Twitter likely driving traffic to new papers and reflecting reader interest. Though this research is conducted on downloads, most of the current research does not isolate HTML views in PDF downloads. Some other studies have focused on whether altmetrics can be used as a predictor of citations. For example, in the case of F1000, it has been found that recommendations have relatively lower predictive power in indicating high citedness as compared to journal citation scores (Waltman & Costas, 2013).

Several studies have been conducted to mention that Altmetrics is the new data source and investigated the association between Altmetrics and citation impact. However, very few studies have been conducted for the content analysis of research articles on Altmetrics. As the child, Altmetrics completes its five years from birth, i.e. 2010, this study reflected in which way the Altmetrics research is going on and which areas of Altmetrics are popular to the researchers for their research topic.

OBJECTIVES AND PURPOSE OF THE STUDY

The primary objectives of this study are to find out the relationship between the citation impact, which is inherently in traditional nature and the 'Altmetrics Score', a modern way to measure the impact of scholarly communications. This study also reveals what type of correlation exists between them.

The primary purpose of this study is to compare citation (traditional impact) and 'Altmetric Score' (Social Impact). In this study, Altmetric rankings of the top-cited ten articles retrieved by ten keywords each in the subject domain of Physics from the citation database WOS are collected to compare the same. This study reveals whether the citation-based and Altmetric score-based rankings show a different pattern or if they are in consonance with each other.

SCOPE AND METHODOLOGY OF THE STUDY

The data for the study is collected from WOS. As it is a case study, 'Physics' has been chosen as the main subject domain for the study. Ten child subjects have been chosen from the 'Physics' domain with the Physics and Astronomy Classification Scheme (PACS), a well-known physics and space science vocabulary control tool. The top ten high cited articles are collected from each child subject from the WOS database. The total number of citation achieved by these articles has been collected from the database mentioned above. 'Altmetric Score' for these articles has been explored using Altmetric Explorer provided by 'Altmetric.com'- the 'Altmetrics' data providing tool. The period has been taken from 2007 to 2019. A correlation study has been carried out between the different parameters of these articles, and with these correlation coefficients, correlation matrix has developed to interpret the result.

DATA PRESENTATION AND ANALYSIS

The data Presentation and Analysis of the study have been depicted below-

Ten child subjects from the 'Physics' domain have been collected from PACS for the study. The subjects are symbolized as S1 to S10, as shown in Table 1.

Table 1:
Subjects and Symbols from Physics Domain

Sl. No.	Subject	Symbol
1	Baryon Decay	S1
2	Fermi Liquid	S2
3	Gamma Decay	S3
4	Globular Cluster	S4
5	Hubbard Model	S5
6	Hubble Constant	S6
7	Lepton	S7
8	Magellanic Cloud	S8
9	Meson	S9
10	Mossbaeur effect	S10

The articles have been retrieved within the year range from 2007 to 2019 i.e. for 13 years. In the year-normalized approach, we have calculated the Average Citations received per unit age (up to 2020) identified by ACA. The working formula of ACA is depicted below-

$$\text{ACA} = \frac{\text{Total number of Citations received by the journal article(TC)}}{\text{Age of the article(up to 2020)}}$$

The statistical applications analyze the statistical parameters for the top ten highly cited articles retrieved from each subject domain identified as S1 to S10 in Table 1. The results have shown in the Tables below. In the following table, AAS stands for 'Altmetric Score'; ACA stands for Average Citation received per unit Age; YOP indicates Year of Publication; TC stands for Times Cited; COR stands for Pearson Product Moment Correlation Coefficient, and AAS stands for 'Altmetric Score'. The Altmetric scores have been retrieved from Altmetric.com.

Table 2: Top-10 Highly Cited Articles of S1

Sl.	Title	Source	TC	YOP	AAS	Age (Upto 2020)	ACA
1	The beam and detector …	Nuclear instruments & methods in physics …	148	2007	0	13	11.38
2	New results on the …	Physics letters b	86	2008	0	12	7.17
3	Observation of the Baryonic Flavor-…	Physical review letters	79	2011	20	9	8.78
4	Search for Very Light CP-…	Physical review letters	67	2008	0	12	5.58
5	Dalitz plot analysis of …	Euro. Phys. Journal c	66	2007	0	13	5.08
6	Discovery potentials of doubly …	Chinese phys. C	57	2018	1	2	28.50
7	Global fit to b -> c tau nu	Journal of high energy phys.	54	2019	1	1	54.00
8	First Observation of the Doubly Charmed …	Phys. Rev. Letters	50	2018	4	2	25.00
9	Precision measurement of the neutron …	Phys. Rev. C	48	2013	6	7	6.86
10	Form factors for Lambda…	Phys. Rev. D	43	2012	1	8	5.38

COR(ACA&TC)	COR(ACA&AAS)	COR(TC & AAS)
-0.22	-0.13	-0.048

Table 3: Top-10 Highly Cited Articles of S2

Sl.	Title	Source	TC	YOP	AAS	Age (Upto 2020)	ACA
1	Weyl and Dirac semimetals in 3-dimensional solids…	Rev. of modern phys.	1481	2018	23	2	740.5
2	A tunable topological insulator in the spin …	Nature	1029	2009	12	11	93.55
3	Fermi-liquid instabilities …	Rev. of modern phys.	878	2007	15	13	67.54
4	Numerical renormalization group method …	Rev. of modern phys.	708	2008	3	12	59
5	Quantum criticality in heavy-fermion metals…	Nature phys.	621	2008	13	12	51.75
6	Colloquium: The transport properties …	Rev. of modern phys.	522	2010	1	10	52.2
7	Metallic and Insulating Phases of …	Science	498	2008	10	12	41.5
8	Electron-Electron Interactions …	Rev. of modern phys.	498	2012	11	8	62.25
9	Topological properties and dynamics …	Nature nanotechnology	496	2013	39	7	70.86
10	Gauge fields in graphene…	Phys. Reports-rev.	394	2010	3	10	39.4

COR(ACA&TC)	COR(ACA&AAS)	COR(TC & AAS)
0.84	0.34	0.26

Table 4: Top-10 Highly Cited Articles of S3

Sl.	Title	Source	TC	YOP	AAS	Age (Upto 2020)	ACA
1	New Constraint on the Existence of …	Physical review letters	345	2013	3	7	49.29
2	New Limit on the Lepton-Flavor-Violating …	Do	186	2011	8	9	20.67
3	A call for new physics: The muon …	Phys.reports-rev.section of phys.letters	176	2018	1	2	88
4	Search for the Pygmy Dipole …	Phys. Rev.letters	170	2009	0	11	15.46
5	In-beam and decay spectroscopy of …	Prog. In part. And nuclear phys.	140	2008	0	12	11.67
6	Hadronic molecule structure of …	Phys. Rev. D	128	2009	1	11	11.65
7	Liquid xenon detectors for particle …	Rev.of modern phys.	121	2010	0	10	12.1
8	Observation of isomeric decays in the …	Phys.rev.letters	106	2007	0	13	8.15
9	On the interpretation of a possible …	Jl. of high energy phys.	93	2016	10	4	23.25
10	The design of the MEG II …	European physical Jl.	82	2018	2	2	41

COR(ACA&TC)	COR(ACA&AAS)	COR(TC & AAS)
0.38	0.03	0.022

Table 5: Top-10 Highly Cited Articles of S4

Sl.	Title	Source	TC	YOP	AAS	Age (Upto 2020)	ACA
1	Coevolution (Or Not) of Supermassive…	Annual rev. of astronomy and Astrophys.	853	2013	86	7	121.86
2	MONITORING STELLAR ORBITS AROUND …	Astrophysical Jl.	783	2009	170	11	71.18
3	The kinematics of the ultra-faint milky way …	Do	552	2007	29	13	42.46
4	Cats and dogs, hair and a hero…	Do	491	2007	37	13	37.77
5	A triple main sequence…	Do	421	2007	9	13	32.38
6	Fast-rotating massive stars and the origin of the abundance patterns	Astronomy & astrophys.	406	2007	0	13	31.23
7	Neutron-capture elements in the early Galaxy	Annual rev. of astronomy and astrophys.	401	2008	1	12	33.42
8	FERMI LARGE AREA TELESCOPE …	Astrophysical jl.supplement series	386	2010	0	10	38.60
9	Quintom cosmology…	Phys.reports-rev.section of phys.letters	359	2010	3	10	35.90
10	Evolutionary stellar population synthesis with MILES – I…	Monthly notices of the royal astronomical society	322	2010	0	10	32.20

COR(ACA&TC)	COR(ACA&AAS)	COR(TC & AAS)
0.91	0.68	0.88

Table 6: Top-10 Highly Cited Articles of S5

Sl.	Title	Source	TC	YOP	AAS	Age (Upto 2020)	ACA
1	Entanglement in many-body systems	Rev. of modern phys.	1557	2008	11	12	129.75
2	Correlated insulator behaviour at half-filling …	Nature	1311	2018	290	2	655.50
3	Ultracold atomic gases in optical lattices…	Advances in phys.	1183	2007	1	13	91.00
4	The physics of dipolar bosonic quantum gases	Reports on progress in phys.	668	2009	2	11	60.73
5	A quantum gas microscope for detecting single atoms…	Nature	640	2009	26	11	58.18
6	A Mott insulator of fermionic atoms in an optical lattice	Nature	614	2008	21	12	51.17
7	Mott Insulators in the Strong Spin-Orbit Coupling …	Physical rev. Letters	595	2009	1	11	54.09
8	Continuous-time Monte Carlo methods …	Rev. of modern phys.	530	2011	7	9	58.89
9	The emergence of magnetism in graphene materials…	Reports on progress in phys.	510	2010	0	10	51.00
10	Probing the Superfluid-to-Mott Insulator Transition…	Science	426	2010	16	10	42.60

COR(ACA&TC)	COR(ACA&AAS)	COR(TC & AAS)
0.57	0.98	0.44

Table 7: Top-10 Highly Cited Articles of S6

Sl.	Title	Source	TC	YOP	AAS	Age (Upto 2020)	ACA
1	Planck 2013 results. XVI…	Astronomy & Astrophys.	5140	2014	226	6	856.67
2	SEVEN-YEAR WILKINSON MICROWAVE …	Astrophysical Jl. Supplement series	5014	2011	75	9	557.11
3	Three-year Wilkinson Microwave Anisotropy Probe (WMAP) …	Astrophysical Jl.supplement series	4457	2007	18	13	342.85
4	NINE-YEAR WILKINSON MICROWAVE …	Astrophysical Jl. Supplement series	2071	2013	87	7	295.86
5	Planck 2015 results XIII…	Astronomy & Astrophys.	1910	2016	367	4	477.50
6	Planck 2013 results. I…	Astronomy & Astrophys.	939	2014	93	6	156.50
7	NINE-YEAR WILKINSON MICROWAVE ANISOTROPY PROBE (WMAP) …	Astrophysical Jl. Supplement series	885	2013	168	7	126.43
8	A 3% solution: determination…	Astrophysical Jl.	858	2011	119	9	95.33
9	The 6dF Galaxy Survey: baryon acoustic oscillations…	Monthly notices of the royal astronomical society	747	2011	21	9	83.00
10	Large MagellanicCloud Cepheid Standards Provide a 1% Foundation for the Determination of the Hubble Constant …	Astrophysical Jl.	658	2019	684	1	658.00

COR(ACA&TC)	COR(ACA&AAS)	COR(TC & AAS)
0.63	0.54	-0.27

Table 8: Top-10 Highly Cited Articles of S7

Sl.	Title	Source	TC	YOP	AAS	Age (Upto 2020)	ACA
1	Parton distributions for the LHC	European physical Jl. C	2262	2009	13	11	205.64
2	New parton distributions for collider physics	Physical rev. D	1120	2010	1	10	112.00
3	MadGraph/MadEvent v4: the new web generation	Jl. Of high energy phys.	828	2007	9	13	63.69
4	Herwig plus physics and manual	European physical Jl. C	804	2008	3	12	67.00
5	Theory and phenomenology of two-Higgs-doublet models	Phys. Reports-rev. Section of phys. Letters	749	2012	14	8	93.63
6	The anatomy of electroweak symmetry…	Do	636	2008	1	12	53.00
7	Parton distributions with LHC data	Nuclear physics B	550	2013	0	7	78.57
8	Improved Search for Muon-Neutrino to Electron-Neutrino Oscillations in MINOS	Physical review letters	485	2011	16	9	53.89
9	Leptogenesis…	Physics reports-review section of physics letters	449	2008	7	12	37.42
10	Order of Magnitude Smaller Limit on the Electric Dipole Moment of the Electron…	Science	448	2014	250	6	74.67

COR(ACA&TC)	COR(ACA&AAS)	COR(TC & AAS)
0.95	-0.05	-0.23

Table 9: Top-10 Highly Cited Articles of S8

Sl.	Title	Source	TC	YOP	AAS	Age (Upto 2020)	ACA
1	Evolution of asymptotic giant branch stars - II…	Astronomy & astrophys.	1033	2008	3	12	86.08
2	Infrared emission from interstellar dust. IV…	Astrophysical Jl.	902	2007	0	13	69.38
3	A 3% SOLUTION: DETERMINATION…	Astrophysical Jl.	858	2011	119	9	95.33
4	FERMI LARGE AREA TELESCOPE …	Astrophysical Jl.supplement series	800	2012	9	8	100.00
5	THINGS: THE HI NEARBY GALAXY SURVEY	Astronomical Jl.	632	2008	4	12	52.67
6	THE OBSERVED PROPERTIES OF DWARF GALAXIES …	Astronomical Jl.	570	2012	44	8	71.25
7	A redetermination of the Hubble…	Astrophysical Jl.	562	2009	1	11	51.09
8	The calibration of mid-infrared star formation rate indicators	Astrophysical Jl.	559	2007	0	13	43.00
9	Star-Formation Histories, Abundances, and Kinematics…	Annual rev. of astronomy and astrophys.	517	2009	1	11	47.00
10	A Universal Stellar Initial Mass Function? A Critical Look at Variations	Do	464	2010	6	10	46.40

COR(ACA&TC)	COR(ACA&AAS)	COR(TC & AAS)
0.78	0.53	0.23

Table 10: Top-10 Highly Cited Articles of S9

Sl.	Title	Source	TC	YOP	AAS	Age (Upto 2020)	ACA
1	Galileon as a local modification of gravity	Physical rev. D	1007	2009	24	11	91.55
2	Heavy quarkonium: progress…	European physical Jl. C	887	2010	0	10	88.70
3	Heavy quarkonium…	European physical Jl. C	887	2011	0	9	98.56
4	Herwig plus plus physics and manual	European physical Jl. C	878	2008	3	12	73.17
5	Theory and phenomenology of two-Higgs-doublet models	Phys. Reports-rev. Section of phys. Letters	836	2012	14	8	104.50
6	Parton distributions with LHC data	Nuclear physics B	643	2013	0	7	91.86
7	CMS physics technical design …	Jl. Of phys. G-nuclear and particle phys.	587	2007	55	13	45.15
8	Parton distributions for the LHC run II	Jl. Of high energy phys.	555	2015	16	5	111.00
9	(g-2)(mu) and alpha(M-Z(2)) re-evaluated…	Jl. Of phys. G-nuclear and particle phys.	450	2010	7	10	45.00
10	(g-2)(mu) and alpha(M-Z(2)) re-evaluated …	Jl. Of phys. G-nuclear and particle phys.	450	2011	7	9	50.00

COR(ACA&TC)	COR(ACA&AAS)	COR(TC & AAS)
0.56	-0.33	-0.15

Table 11: Top-10 Highly Cited Articles of S10

Sl.	Title	Source	TC	YOP	AAS	Age (Upto 2020)	ACA
1	Room-temperature coexistence of large electric polarization…	Physical rev. B	400	2007	0	13	30.77
2	A unified model of protein dynamics	Proceedings of the national academy of sciences of the united states of america	397	2009	11	11	36.09
3	Influence of Feature Size, Film Thickness, and Silicon Doping …	Jl. of physical chem. C	365	2009	3	11	33.18
4	Year-2008 nuclear quadrupole moments	Molecular physics	297	2008	0	12	24.75
5	The electronic phase …	Nature materials	292	2009	3	11	26.55
6	Identification of catalytic sites for oxygen	Nature materials	281	2015	21	5	56.20
7	Ferromagnetism in Fe-doped ZnO nanocrystals…	Physical review B	270	2007	0	13	20.77
8	Infinite-layer iron oxide with a square-planar coordination	Nature	248	2007	3	13	19.08
9	Alumina-Supported CoFe Alloy Catalysts Derived from Layered-Double-Hydroxide Nano sheets…	Advanced materials	220	2018	10	2	110.00
10	Structure of the catalytic sites in Fe/N/C-catalysts …	Physical chemistry chemical physics	218	2012	0	8	27.25

COR(ACA&TC)	COR(ACA&AAS)	COR(TC & AAS)
-0.29	0.56	-0.013

After analyzing the above Tables, the correlation values have been organized to develop a correlation matrix. The matrix shows the association between different parameters. Most values are on a positive scale, whereas some are on a negative scale.

Table-12: Correlation Matrix of different parameters

Sl.No.	Subjects	COR(ACA and AAS)	COR(AASand TC)	COR(ACA and TC)
1	Baryon Decay	**-0.22**	**-0.13**	**-0.048**
2	Fermi Liquid	0.84	0.34	0.26
3	Gamma Decay	0.38	0.03	0.022
4	Globular Cluster	0.91	0.68	0.88
5	Hubbard Model	0.57	0.98	0.44
6	Hubble Constant	0.63	0.54	**-0.27**
7	Lepton	0.95	**-0.05**	**-0.23**
8	Magellanic Cloud	0.78	0.53	0.23
9	Meson	0.56	**-0.33**	**-0.15**
10	Mossbaeur effect	**-0.29**	0.56	**-0.013**

Chart-1: Graphical representation of Correlation Matrix

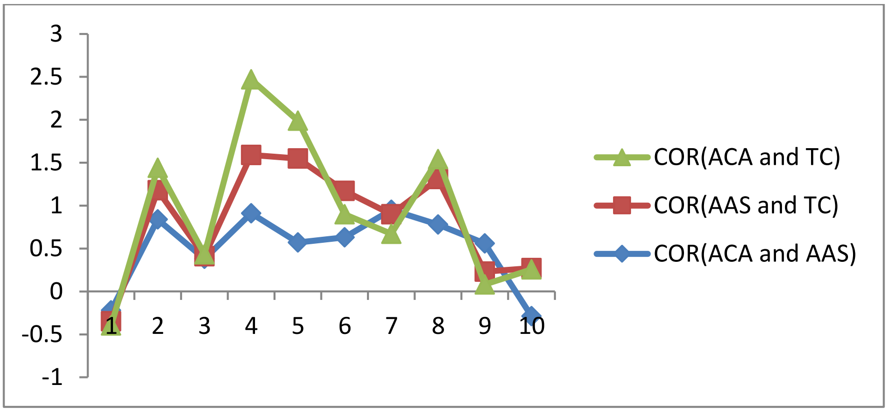


Table-13: Values of Correlation Coefficient

	Value of Correlation Coefficient		
Range	**<0 (Negative)**	**0-0.5 (Weak positive)**	**>0.5-1 (Strong positive)**
No. of results	10	7	13

CONCLUSION

From Table 12, it has been observed that out of 30 Correlation Coefficients of Table 12, only ten coefficients show negative values, seven coefficients show weak positive values, and most of the coefficients that are thirteen show strong positive values. For the correlation between ACA and AAS, only two values are negative, only one is weakly positive, and seven are strongly positive. However, for AAS and TC, three values are negative, two are weak positive, and five are strongly positive. Thus the relationship between ACA and AAS is more consonant than between AAS and TC. Now, ACA and TC are classical metrics measuring academic impact, while AAS is a metric of modern techniques measuring social impact. The consonance between classical closed-access-based and current open metrics signals the growing importance of social networking-based scholarly communication. Here, a technique for a comparative study between classical and modern metrics have been introduced that shows a gradual outnumbering of modern metrics over classical one.

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