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Correlating Research Impact of e-Learning Using Citation Counts and Altmetrics Score

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Abstract

Altmetrics presents an alternative metrics which ensure and monitor the reach and impact of scholarship and research through online interactions in terms of Blogs, Twitter, Facebook, Mendeley, Cite U like, mentions and others social platforms. The objective of the paper is to determine the research impact on the topic eLearning using Scopus Database. Altemetrics plugin has been used to calculate the Altmetrics Score. A correlation of citation with Altmetric Score is presented. The study reveals that there is relationship/correlation exist between the citation of the top fifty highly cited papers on e-learning and their Altmetrics score and Dimensions Badge.

Keywords: Altmetrics, e-Learning, Citation, Dimensions, Research Assessment, Scientometrics.

1. Introduction

Citation Indexing, developed by Garfield in the year 1955 presented a strong foundation for the evaluation and research assessment of scientific productivity. Science Citation Index (SCI) which came out in 1964 and Journal Impact Factor in the mid-1960s opens a novel approach of research assessment metrics. The emerging disciplines like Scientometrics, Informatics, Webometrics and Bibliometrics supported these tools and presented a holistic view of evaluation and assessment of scientific publications. These assessment techniques are mainly associated with the citation processes, including the number of publications, citation counts and peer reviews of a researcher or journal or institution (Haustein and Thelwall, 2013). Those were the days when these matrics considered only means of assessment of research. However, Informatics, Webometrics, Bibliometrics and Scientometrics seem to be situated in a similar point of development as in the 1960s. The main advantages of Altmetrics over traditional Bibliometrics and Webometrics is that they offer fast, real-time indications of impact, they are openly accessible and transparent, include a broader non-academic audience, and cover more diverse research outputs and sources (Costas and Wouters 2012). In contrast to bibliometric indicators, which count only mentions (citations)and production (publications) of scholarly outputs in the academic publishing world, Altimetric indicators consider a broader and more complex range of actions related to the usage, mentioning, sharing, and bookmarking of research publications. An evolution of Research Assessment Metrics is presented in table 1.

Table 1: Evolution of Research Assessment Metrics

1955	Citation Indexing	**2004**	Scopus
1964	Science Citation Index	**2005**	h-index
1965	Journal Impact Factor	**2006**	PLOS Metrics
1967	OCLC & WorldCat	**2007**	Eigenfactor Metrics
1975	Journal Citation Reports	**2008**	Mendeley
1996	PubMed	**2009**	DataCite Founded
1996	PubMed ID (PMID)	**2009**	Becker Model
1997	Big Data	**2010**	Altmetrics
1997	Science Direct	**2010**	SCImago
1997	Google Search	**2012**	ORCID IDs
2000	DOIs Introduced	**2012**	Plum Analytics
2000	CrossRef Begins	**2012**	Altmetric.com
2002	Web of Knowledge	**2014**	REF
2004	Google Scholar	**2016**	CiteScore

Altmetrics stands for 'Alternative metrics' where alternative means the measurement of academic writing impact other than traditional citation methods. Altmetrics measures the web-driven scholarly interaction through counting the number of mentions on social media platforms such as tweeter, Facebook and blog etc. Altmetrics is a new better way to know all the impact on the research, is a data source from discussion happening online around the research. Altmetrics can be gathered from any online discussion platform as social media, forums etc. A much broader definition is given on the website Altemetic.org (http://altmetrics.org/manifesto/) as "Altmetrics expand the horizon of the impact through the diverse expression of scholarship. Priem et al. (2010) said Altmetrics is a comparatively current source to measure the impact of scholarly publications. Haustein et al. (2014) defined Altmetrics as an emerging alternative means to measure the impact of scholarly contain through social media platforms and tools. Weller (2015) describes Altmetrics as an evaluation method derived by the activities of users on various social media platforms. "Altmetrics refers to data sources, tools, and metrics (other than citations) that provide potentially relevant information on the impact of scientific outputs (e.g., the number of times a publication has been tweeted, shared on Facebook, or read in Mendeley). Altmetrics opens the door to a broader interpretation of the concept of impact and more diverse forms of impact analysis" (Waltman & Costas, 2014, p. 433). Since 2010, Altmetrics has been emerging as a new source of metrics to measure scholarly impact (Priem et al. 2010). Counting the number of web citations to offline publications can give evidence of research impact, since web citations correlate with traditional citations (Smith 2004; Vaughan and Shaw 2004, 2005). Haustein et al. (2014a, p. 1145) opined: ''Altmetrics, indices based on social media platforms and tools, have recently emerged as alternative means of measuring scholarly impact.'' Weller (2015, pp. 261–262) states that''Altmetrics-evaluation methods of scholarly activities that serve as alternatives to citation-based metrics (...)'' and ''Altmetrics are evaluation methods based on various user activities in social media environments."

Altmetric adds Dimensions citation data to highlight academic productivity. Dimensions badges are interactive visualisations tool that showcases the citation data for individual publications. Altmetrics is comparatively a new metrics or tool for citation count. There are only a few studies undertaken on Altmetrics worldwide; Bar-Ilan, Shema do some of them,

and Thelwall (2014), Haustein (2014), and Priem (2014). Lutz Bornmann presented a study on Altmetrics where Altmetrics data is used to measure the societal impact in the area of research, and it is found in the study that Altmetrics data can produce societal impact. The scope of this paper is to correlate research impact of e-Learning using citation counts and Altmetrics using the Scopus database.

2. Methodology & Research Questions

The data of the top 50 cited publication in the domain of e-learning is collected from the Scopus database, which is a multidisciplinary citation database. A search string was formulated with the help of following key terms using Boolean Search Operator:

(TITLE-ABS-KEY (e AND learning) OR TITLE-ABS-KEY (online AND learning) OR TITLE-ABS-KEY (computer AND based AND learning) OR TITLE-ABS-KEY (web AND based AND learning) OR TITLE-ABS-KEY (blended AND learning) filtered with "cited by".

The retrieved data of top 50 highly cited publications were analysed by Dimensions.ai (*https://app.dimensions.ai/discover/publication*) which is a most comprehensive next-generation linked research information system/database that provides real-time online attention data using Altmetrics which shows the online interaction over the scholarly publications. The data captured was done during September 01-18, 2020. The data were tabulated and analysed by MS Excel software. The complete list of titles along with the Altmetric Score and Dimensions is given in Annexure-I. The key research questions of the study were:

> **RQ1:** Is there a relationship between Number of Citations (Cited by) with Altemtric Score?
> **RQ2:** Is there a relationship between Number of Citations (Cited by) with Dimensions?

3. Data Analysis and Research Findings

Based on resultant data depicted in annexure-I, a relationship between Citation to Almetric Score and Citation to the Dimension were analysed using SPSS software. Describe statistics, as well as Pearson Correlation, were calculated. The details of the results are discussed below:

3.1 Relation of Citation to Almetric Score

The research question was to find out the answer of the question that Is there a relationship between Citations (Cited by) with Altemtric Score?

A Pearson correlation analysis was conducted to examine whether there is a relationship between Number of times a paper is cited (total citations) with Altemtric Score. The results revealed a significant and positive relationship ($r = .284$, $N = 50$, $p = .046$). The correlation was weak in strength. A higher number of citations were associated with a lower level of Altmetrics score (see Table 1 & 2). It means that the papers having higher citations may not have higher Altmetrics score as the correlation between citations and Altemtric Score is weak.

Table 2: Descriptive Statistics

	Mean	Std. Deviation	N
Cited by	286.56	286.114	50
Altmetrics Score	6.02	8.712	50

Table 3: Correlation between Citations and Altemetrics

		Cited by	Altmetrics Score
Cited by	Pearson Correlation	1	.284*
	Sig. (2-tailed)		.046
	N	50	50
Altmetrics Score	Pearson Correlation	.284*	1
	Sig. (2-tailed)	.046	
	N	50	50
*. Correlation is significant at the 0.05 level (2-tailed).			

3.2 Relation of Citation to the Dimension

The second research question was to find out the answer to the question that is there a relationship between Citations (Cited by) with Dimensions?

A Pearson correlation analysis was conducted to examine whether there is a relationship between numbers of times a paper is cited (total citations) with Dimensions Badge. The results revealed a significant and positive relationship (r = .996, N = 50, p = .000). The correlation was strong in strength. A higher number of citations were associated with a higher level of Dimensions (see Table 3 & 4). It means that the papers having higher citations will have higher Dimensions Badge as correlations between citations and Dimensions Badge is Strong.

Table 4: Descriptive Statistics

	Mean	Std. Deviation	N
Cited by	286.56	286.114	50
Dimentions	240.80	230.647	50

Table 5: Citations and Dimensions

		Cited by	Dimensions
Cited by	Pearson Correlation	1	.996**
	Sig. (2-tailed)		.000
	N	50	50
Dimensions	Pearson Correlation	.996**	1
	Sig. (2-tailed)	.000	
	N	50	50
**. Correlation is significant at the 0.01 level (2-tailed).			

4. Discussion and Conclusions

The study is hopefully given an insight into how are Altimetric and citation measures related? Do dimensions mentions can be correlated with a citation for a given article? The study suggests that Altmetrics, dimensions and citations measure, at least to a certain extent, are correlated, and correlation found. Altmetrics and Citations are weakly correlated. However, the dimensions and citations are strongly correlated. It means that the papers having higher citations may not have higher Altmetrics score. Further, as the correlation between Citations and Dimensions are strong, the papers having higher citations will have higher Dimensions Badge. The presence of such a relationship, however, would demonstrate that citations are correlated with Altimetric (weak) and dimensions (strong). Given this scenario, where this study is limited to the top 50 papers of eLearning retrieved through Scopus database, the correlations measured should be examined in order to understand the validity of using such metrics in the broad context and numbers of research publications.

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Annexure-I: Citations, Alemetrics Score and Dimensions of Top 50 Papers on E-Learning

SN	Title	Authors	Year	Cited by	Altmetrics Score	Dimensions
1	Critical Inquiry in a Text-Based Environment: Computer Conferencing in Higher Education	Garrison D.R., Anderson T., Archer W.	1999	1659	4	1374
2	Blended learning: Uncovering its transformative potential in higher education	Garrison D.R., Kanuka H.	2004	1355	12	1024
3	Digital game-based learning: Towards an experiential gaming model	Kiili K.	2005	672	17	541
4	al Learning Environments, social media, and self-ed learning: A natural formula for connecting formal ormal learning	Dabbagh N., Kitsantas A.	2012	598	36	541
5	Findings on Facebook in higher education: A comparison of college faculty and student uses and perceptions of social networking sites	Roblyer M.D., McDaniel M., Webb M., Herman J., Witty J.V.	2010	583	32	484
6	Researching the community of inquiry framework: Review, issues, and future directions	Garrison D.R., Arbaugh J.B.	2007	444	1	382
7	The use of flipped classrooms in higher education: A scoping review	O'Flaherty, J., Phillips C.	2015	429	30	401
8	Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media	Gikas, J., Grant M.M.	2013	397	11	374
9	Investigating faculty decisions to adopt Web 2.0 technologies: Theory and empirical tests	Ajjan H., Hartshorne R.	2008	391	0	342
10	A survey of current research on online communities of practice	Johnson C.M.	2001	334	3	274
11	Sense of community, perceived cognitive learning, and persistence in asynchronous learning networks	Rovai A.P.	2002	329	0	280
12	Development of an instrument to measure classroom community	Rovai A.P.	2002	322	0	254
13	Successful implementation of e-Learning Pedagogical considerations	Govindasamy T.	2001	321	0	244
14	Improving online learning: Student perceptions of useful and challenging characteristics	Song L., Singleton E.S., Hill J.R., Koh M.H.	2004	297	3	235
15	Facebook: An online environment for learning of English in institutions of higher education?	Kabilan M.K., Ahmad N., Abidin M.J.Z.	2010	294	6	240
16	E-Learning, online learning, and distance learning environments: Are they the same?	Moore J.L., Dickson-Deane C., Galyen K.	2011	270	6	256
17	The experience of three flipped classrooms in an urban university: An exploration of design principles	Kim M.K., Kim S.M., Khera O., Getman J.	2014	268	5	234
18	Developing a community of inquiry instrument: Testing a measure of the Community of Inquiry framework using a multi-institutional sample	Arbaugh J.B., Cleveland-Innes M., Diaz S.R., Garrison D.R., Ice P., Richardson J.C., Swan K.P.	2008	258	0	213
19	The first decade of the community of inquiry framework: A retrospective	Garrison D.R., Anderson T., Archer W.	2010	251	3	203
20	Exploring causal relationships among teaching, cognitive and social presence: Student perceptions of the community of inquiry framework	Garrison D.R., Cleveland-Innes M., Fung T.S.	2010	243	0	200
21	A study of teaching presence and student sense of learning community in fully online and web-enhanced college courses	Shea P., Sau Li C., Pickett A.	2006	231	16	182
22	An examination of asynchronous communication experiences and perspectives of students in an online course: A case study	Vonderwell S.	2003	221	1	186
23	Shift happens: Online education as a new paradigm in learning	Harasim L.	2000	221	15	202
24	Meaningful interaction in web-based learning: A social constructivist interpretation	Woo Y., Reeves T.C.	2007	210	4	180
25	In search of higher persistence rates in distance education online programs	Rovai A.P.	2003	208	0	182

26	Facilitating online discussions effectively	Rovai A.P.	2007	207	1	163
27	Research focus and methodological choices in studies into students' experiences of blended learning in higher education	Bliuc A.-M., Goodyear P., Ellis R.A.	2007	202	4	140
28	Quality in blended learning: Exploring the relationships between on-line and face-to-face teaching and learning	Ginns, P., Ellis R.	2007	190	4	174
29	Tracking student behaviour, persistence, and achievement in online courses	Morris L.V., Finnegan C., Wu S.-S.	2005	172	0	143
30	A framework for institutional adoption and implementation of blended learning in higher education	Graham C.R., Woodfield W., Harrison J.B.	2013	161	15	133
31	Self-regulated learning strategies & academic achievement in online higher education learning environments: A systematic review	Broadbent J., Poon W.L.	2015	158	6	155
32	Revisiting methodological issues in transcript analysis: Negotiated coding and reliability	Garrison D.R., Cleveland-Innes M., Koole M., Kappelman J.	2006	155	0	134
33	Measuring self-regulation in online and blended learning environments	Barnard L., Lan W.Y., To Y.M., Paton V.O., Lai S.-L.	2009	148	0	123
34	A constructivist approach to online college learning	Rovai A.P.	2004	142	2	113
35	Research in online and blended learning in the business disciplines: Key findings and possible future directions	Arbaugh J.B., Godfrey M.R., Johnson M., Pollack B.L., Niendorf B., Wresch W.	2009	140	0	124
36	Serious social media: On the use of social media for improving students' adjustment to college	Deandrea D.C., Ellison N.B., Larose R., Steinfield C., Fiore A.	2012	136	12	122
37	The effect of peer feedback for blogging on college students' reflective learning processes	Xie Y., Ke F., Sharma P.	2008	136	0	123
38	Creating a cognitive presence in a blended faculty development community	Vaughan N., Garrison D.R.	2005	133	3	113
39	Learning or lurking? Tracking the "invisible" online student	Beaudoin M.F.	2002	133	0	123
40	Learning analytics should not promote one size fits all: The effects of instructional conditions in predicting academic success	Gašević D., Dawson S., Rogers T., Gasevic D.	2016	132	10	120
41	Interaction, Internet self-efficacy, and self-regulated learning as predictors of student satisfaction in online education courses	Kuo Y.-C., Walker A.E., Schroder K.E.E., Belland B.R.	2014	132	4	118
42	To blog or not to blog: Student perceptions of blog effectiveness for learning in a college-level course	Halic O., Lee D., Paulus T., Spence M.	2010	131	0	98
43	The impact of two types of peer assessment on students' performance and satisfaction within a Wiki environment	Xiao Y., Lucking R.	2008	126	0	98
44	Blended learning: A dangerous idea?	Moskal P., Dziuban C., Hartman J.	2013	123	10	99
45	Using a social networking site for experiential learning: Appropriating, lurking, modelling and community building	Arnold N., Paulus T.	2010	114	1	109
46	The role of structure, patterns, and people in blended learning	Derntl, M., Motschnig-Pitrik, R.	2005	114	0	90
47	Learning in MOOCs: Motivations and self-regulated learning in MOOCs	Littlejohn A., Hood N., Milligan C., Mustain P.	2016	113	21	119
48	Does "teaching presence" exist in online MBA courses?	Arbaugh J.B., Hwang A.	2006	111	0	98
49	Assessing metacognition in an online community of inquiry	Akyol Z., Garrison D.R.	2011	108	0	90
50	Student perceptions and achievement in a university blended learning strategic initiative	Owston R., York D., Murtha S.	2013	105	3	90

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