

Emerging Trends for Sustainable Development in Libraries

A Perspective of Self - Reliant Learning

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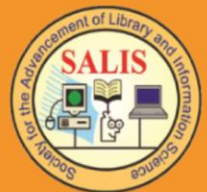
- ❖ Rev. Dr. D. Thomas Alexander SJ
❖ Dr. T. Raja ❖ Dr. K. Ramasamy ❖ Dr. A. M. Venkatachalam



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RESEARCH PRODUCTIVITY ON 'FLIPPED CLASSROOM': A SCIENTOMETRIC ANALYSIS BASED ON 'WEB OF SCIENCE'

¹Raja, T (Dr.) ²Michael J Leo, A (Dr.) ³Ravi Kumar Kennedy I (Dr.)

¹Librarian, St. Xavier's College of Education (Autonomous), Palayamkottai, Tami Nadu
E-Mail Id: rajathangiah@gmail.com

²Assistant Professor, St. Xavier's College of Education (Autonomous), Palayamkottai, Tami Nadu,
E-Mail Id: amjlsxce@gmail.com

³NTS, St. John's College, Palayamkottai, Tirunelveli, Tami Nadu
E-Mail: Id: i.r.k.kennedy1996@gmail.com

Abstract

This paper explores the research productivity in the area of flipped classroom by the faculty of sciences and social sciences, as indexed in the web of science database from 2013 to 2022. Out of the 5904 articles considered for the analysis, 5148 (87%) are journal articles. The journal "NICOTINE & TOBACCO RESEARCH" published 574 articles (3.26 per cent) and UNIV CALIF SAN FRANCISCO is most prolific institution with 602 articles (10.19 per cent). The prolific author namely BENOWITZ NL contributed 104 articles and got 3466 citations with 32 h-index. The United States of America got 87146 citations and 24.21 average article citations. This paper concludes that number of research contributions in flipped classroom steadily increased. It is suggested to explore and apply the results of adopting this method of flipped classroom in classroom teaching regularly.

Keywords: *Flipped Classroom, Research productivity, Scientometrics, Productive Institutions, Prolific Authors*

Introduction

The flipped classroom is the innovative teaching method in the last 15 years. In recent years, the flipped classroom has become one of emerging technologies in education and it can be a standard of teaching-learning practice to foster students' active learning in higher education (Hamdan, McKnight, McKnight, & Arfstrom, 2013). The flipped classroom is an approach to teaching and learning activities where students watch a video lesson outside the class through distance learning and have hands-on activities in the class. Halili and Zainuddin (2015) note that the flipped classroom or reverse classroom is an element of blended learning, integrating both face-to-face learning in the class through group discussion and distance learning outside the class by watching asynchronous video lessons and online collaboration. Blended learning is simply defined as the activity of teaching and learning which combined face-to-face physical activities with online learning (Heilesen, 2010; Lean, Moizer, & Newbery, 2014; Poon, 2014). Blended learning was practiced by mixed face-to-face and distance teaching and learning or the integration of both distance and face-to-face modalities to deliver instruction. Flipped classroom is also known as a student-centred approach to learning where the students are more active than the instructor in the classroom activity. In this case, the instructor acts as a facilitator to motivate, guide, and give feedback on students' performance (Sams & Bergmann, 2012). India has recently adopted this method at schools. This paper is a scientometric study of the research publications related to the flipped classroom. This study finds the growth and development of the publications on "flipped classroom" as indexed in Web of Science database.



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Scope of Scientometric Study

The term scientometric was coined in 1969 by the Russian scientists Nalimov and Mulechenko. The main scope of scientometric study is to provide a quantitative analysis of the subject or specific term including keyword analysis, author productivity, author citations, country wise productivity, affiliating institutions etc. Library and information science professionals are very active and prominent in scientometric research.

Significance of the Study

Around 2007, a new approach of teaching began to gain support. It was pioneered by two high school teachers in Colorado namely Jonathan Bergmann and Aaron Sams. The flipped classroom technology, then, slowly was adopted in the schools across the globe and last 10 years had seen high utilization of flipped classroom activities and high publication of research articles written by the researchers in the field of science and social sciences on flipped classroom. Thus, this is the right time to reflect upon the research output on flipped classroom in and around the world. This study identifies the research output on flipped classroom for the last ten years.

Literature Review

Julia et al. (2020) identified and analyzed the articles examining the flipped classroom model that has been published in several reputable international journals published during 2010-2019, using bibliometric studies. The research was conducted using a 4-stages systematic mapping method: (1) searching for articles using the Publish or Perish application in the Scopus database, (2) classifying the articles for the bibliometric analysis, (3) checking and completing the metadata of those articles, and (4) conducting bibliometric analysis using VOSviewer application. The analysis produced seven findings : (1) the trend of flipped classroom publications continued to increase from 2013-2019; (2) the ten most contributive journals has published 88 articles by 2019; (3) the ten most cited articles has produced 1,155 citations; (4) the three highest order of author keywords most widely used in flipped classroom articles were flipped classroom, active learning, and blended learning; (5) author collaboration with strong links only occurred in 21 authors through one document; (6) institutional collaboration with strong links formed through 28 collaborating institutions; and (7) state statistics were formed into three clusters and spread across various countries through contributions from authors who were in charge of 456 institutions.

Zainuddin and Halili (2016) analyzed the trends and contents of flipped classroom research based on 20 articles that report on flipped learning classroom initiatives from 2013–2015. The content analysis was used as a methodology. The results of the analysis were interpreted using descriptive analysis, percentages, and frequencies. This analysis found that various fields practiced flipped classroom approach, and some technology tools were used as the online platform for its practice. Analysis of the impacts showed that flipped classroom brought positive impacts toward students' learning activities such as achievement, motivation, engagement, and interaction.

Kushalri and Ahmi (2021) examined the current dynamics of the flipped classroom studies and to propose a direction for future research for the field. Using a bibliometric approach, a sample of 1557 documents from the Scopus database was retrieved to identify research activity on the flipped classroom.

del Arco, Mercadé-Melé, Ramos-Pla and Flores-Alarcia (2022) identified the main existing trends and emerging strategic lines of research with respect to the FC pedagogical model. A bibliometric study was carried out by analyzing the international scientific production found in the Web of Science

(WoS) database. A total of 2,194 articles were reviewed during the period from 2007 to 2021. The results showed an increase in publications on FC from 2013 onwards, reaching a significant peak in the scientific literature in the last 2 years.

Objectives for the Study

The following objectives are framed for the study:

- ❖ To find the forms of publications on Flipped Classroom research output
- ❖ To analyze the top 10 authors on Flipped Classroom research output
- ❖ To understand the most productive institutions in Flipped Classroom research output
- ❖ To investigate the various sources of Flipped Classroom research output
- ❖ To explore the contributions of different countries in Flipped Classroom research output
- ❖ To understand the most productive authors' impact on Flipped Classroom research output

Methodology

This study analyzed the results extracted from the Web of Science database. The required data for the present study is the bibliographical records on 'flipped classroom' downloaded from the Web of Science database during 2012- 2022.

Data Analysis and Interpretation

Table 1: Main Information

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2012:2022
Sources (Journals, Books, etc)	1144
Documents	5904
Average years from publication	4.7
Average citations per documents	22.22
Average citations per year per doc	3.655
References	134107
DOCUMENT TYPES	
article	5148
Others	166
review	590
AUTHORS	
Authors	20555
Author Appearances	38246
Authors of single-authored documents	105
Authors of multi-authored documents	20450
AUTHORS COLLABORATION	
Single-authored documents	122

Documents per Author	0.287
Authors per Document	3.48
Co-Authors per Documents	6.48
Collaboration Index	3.54

Table 1 reveals that the research output on flipped classroom produced by the research community includes most popular forms of publications. Out of the 5904 publications, 5148 publications (87 per cent) are journal articles, followed by reviews (590 publications, 10 per cent) and other type of sources (166 publications, 2.8 per cent). 20555 authors contributed the publications. There were 122 single authored documents. The author per document value was 3.48 while collaboration index of the research output is 3.54. The average citation per documents was 22.22 while the average citation per year per document is 3.655.

Table 2 :Top 10 Productive Authors

Authors	Articles	Articles Fractionalized
BENOWITZ NL	104	17.08
CUMMINGS KM	88	10.88
EISSENBERG T	85	15.60
HATSUKAMI DK	73	10.36
GONIEWICZ ML	67	10.06
MCNEILL A	66	9.83
O'CONNOR RJ	62	9.63
FONG GT	61	5.89
BORLAND R	59	8.89

Table 2 reveals that out of the 5904 publications, the highest number of 104 articles (1.76 per cent) was authored by BENOWITZ NL, M. followed by 88 articles (1.49 per cent) by CUMMINGS KM, 85 articles (1.43 per cent) by EISSENBERG T, 73 articles (1.23 per cent) by HATSUKAMI DK, 67 articles (1.13 per cent) by GONIEWICZ ML, 66 articles (1.11 per cent) by MCNEILL A, 62 articles (1.05 per cent) by O'CONNOR RJ, 61 articles (1.03 per cent) by FONG GT and 59 articles (.99 per cent) by BORLAND R.

Table 3:Most Productive Institutions

Affiliations	Articles	Percentage
UNIV CALIF SAN FRANCISCO	602	10.19
UNIV MINNESOTA	456	7.72
VIRGINIA COMMONWEALTH UNIV	353	5.97
BROWN UNIV	296	5.01
YALE UNIV	289	4.89
UNIV PENN	288	4.87
UNIV TORONTO	273	4.62
UNIV PITTSBURGH	231	3.91
UNIV VERMONT	231	3.91
JOHNS HOPKINS UNIV	174	2.94

Table 3 states that out of the 5904 publications, 602 articles (10.19 per cent) were published by the University CALIF SAN FRANCISCO, followed by 456 articles (7.72 per cent) from the University MINNESOTA , 353 articles (5.97 per cent) from the VIRGINIA COMMONWEALTH University, 296 articles (5.01 per cent) from the BROWN University, 289 articles (4.89 per cent) from the YALE University, 288 articles (4.87 per cent) from the University PENN, 273 articles (4.62 per cent) from the University TORONTO and 231 articles (3.91 per cent) from the University PITTSBURGH and University VERMONT and 174 articles (2.94 per cent) from the JOHNS HOPKINS University in 'Flipped Classroom' research.

Table 4:Source-wise distribution of Publications

Sources	Articles	Percentage
NICOTINE & TOBACCO RESEARCH	574	9.72
INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH	242	4.09
DRUG AND ALCOHOL DEPENDENCE	232	3.92
TOBACCO CONTROL	209	3.53
ADDICTIVE BEHAVIORS	208	3.52
PLOS ONE	167	2.82
ADDICTION	158	2.67
BMC PUBLIC HEALTH	126	2.13
TOBACCO INDUCED DISEASES	82	1.38
BMJ OPEN	79	1.33

Table 4 reveals that the journal "NICOTINE & TOBACCO RESEARCH" is the most productive source with 574 articles (9.72 per cent) followed by 242 articles (4.09 per cent) published in the INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH, 232 articles (3.92 per cent) published in the DRUG AND ALCOHOL DEPENDENCE , 209 articles (3.53 per cent) published in the TOBACCO CONTROL, 208 articles (3.52 per cent) published in the ADDICTIVE BEHAVIORS, 167 articles (2.82 per cent) published in the PLOS ONE, 158 articles (2.67 per cent) published in the ADDICTION, 126 articles (2.13 per cent) published in the BMC PUBLIC HEALTH, 82 articles (1.38 per cent) published in the TOBACCO INDUCED DISEASES, and 79 articles (1.33 per cent) published in the BMJ OPEN journal.

Table 5:Ten Most Productive Countries

Country	Total Citations	Average Article Citations
USA	87146	24.21
UNITED KINGDOM	13497	33.83
AUSTRALIA	3614	18.53
CANADA	3203	19.41
ITALY	2725	33.64
CHINA	2050	10.30
GREECE	1741	58.03

SWITZERLAND	1647	17.34
GERMANY	1511	19.88
NETHERLANDS	1407	20.69

Table 5 reveal that 87146 citations (24.21 average article citations) were received by USA, followed by 13497 citations (33.83 average article citations) by the United Kingdom, 3614 citations (18.53 average article citations) by Australia, 3203 citations (19.41 average article citations) by Canada, 2725 citations (33.64 average article citations) by Italy, 2050 citations (10.30 average article citations), 1741 citations (58.03 average article citations) by Greece, 1647 citations (17.34 average article citations) by Switzerland, 1511 citations (19.88 average article citations) by Germany, and 1407 citations (20.69 average article citations) by Netherlands.

Table 6: Impact of Top Ten Authors

Element	h_index	g_index	m_index	TC	NP
BENOWITZ NL	32	55	2.909	3466	102
EISSENBERG T	32	64		4253	85
CUMMINGS KM	30	52	2.727	2992	88
GONIEWICZ ML	27	64		4372	64
BORLAND R	25	49		2509	59
MCNEILL A	24	54		3010	65
JACOB P	23	41	2.091	2720	41
O'CONNOR RJ	23	42		1888	60
FONG GT	22	44		2047	61
HATSUKAMI DK	22	32	2	1284	70

Table 6 explores that BENOWITZ NL got 3466 citations with 32 h-index, followed by EISSENBERG T (4253, 32), CUMMINGS KM (2992, 30), GONIEWICZ ML (4372, 27), BORLAND R (2509, 25), MCNEILL A (3010, 24), JACOB P (2720, 23), O'CONNOR RJ (1888, 23), FONG GT (2047, 22) and HATSUKAMI DK got 1284 citations and h-index respectively.

Major Findings of the Study

- ❖ Out of 5904 publications, 5148 (87 Per cent) from Journal articles
- ❖ 3.54 is the author collaboration index.
- ❖ BENOWITZ NL, the most productive author, contributed 104 articles
- ❖ BENOWITZ NL had obtained 3466 citations with 32 h-index
- ❖ United States of America got 87146 citations and 24.21 average article citations
- ❖ The journal NICOTINE & TOBACCO RESEARCH journal contributed 574 articles (9.72 per cent)
- ❖ The institution UNIV CALIF SAN FRANCISCO contributed 602 articles (10.19 per cent)

Conclusion

Flipped Classroom is one of the latest innovative technologies of teaching methods during this covid-19 period. A number of countries have applied this type of teaching methods for their budding students. This study finds out the increased growth of research productivity on flipped classroom across the world from year to year. This study recommends that more funding assistance should be extended by the agencies for encouraging the projects for writing articles and user studies on flipped classroom in the schools.

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