# A Bibliometric study on Research Analytics and Programming Tools

**Gaikwad Deepa Namdeo**
Research Scholar (Ph.D.)
Dept. of Library & Information Science
Dr. Babasaheb Ambedkar Marathwada University,
Aurangabad. (MS)India.
E-mail:dipti.dg85@gmail.com

**Dr. Dongare Sudesh Nasiket**
Librarian
M.S.P. Mandal's Deogiri College,
Aurangabad, (MS) India.
E-mail: sudeshdongaredca@gmail.com

**Abstract:**

Presents a study of the trends in authorship pattern and collaborative research on Research trends and Programming Tools. In this study examines three of Bibliometric laws i.e. Lotkas's law, (No. of authors) Bradford law, (No. of journals) Zip's law of (Word Occurrence). Also analyses the trends on authorships such as Relative Growth rate & Doubling Time, Pareto 80/20Rule, Examine research performance national as well as Global contexts, The paper is based on Bibliometric analysis of total 142 research articles contributed by the authors.in 2012-2021 total ten years' time period. It was seen that researchers utilize latest Technologies and Tools for new discovery of knowledge. The study reveals the conclusion about the three Laws and the findings must reveal various aspects of the characteristics and patterns of contributions of the study.

**Keywords:** Bibliometric, Research Analytics, Programming Tools, Authorship pattern, Pareto 80/20 principle, Bibliometric laws.

## 01. Introduction:

The objective of the present study is to highlight the concept of Bibliometrics, Scientometric, and Laws of Bibliometrics, to specify objective, hypothesis, limitations, methodology and conspectus of the study. 'Alan Pritchard' in 1969 has coined the term bibliometrics. To denote a new discipline where quantitative methods were employed to prove scientific communication process by measuring and analyzing various aspects of written documents. Pritchard (1968) "Application of mathematical methods to books and other media of communication." Bibliometrics is a fast developing area in information science, which is defined as a discipline that investigates the properties and behaviour of information. Bibliometrics Constitutes one of the major thrust of research in the field of library and information science. It utilizes quantitative analysis and statistics to describe patterns of publications within a given field or body of

literature. Knowledge is dynamic and multidimensional in nature. The new researches and the thirst for knowledge has led to the generation of new work.

Bibliometric have extensive application in library and information field in identifying the research trends in particular subject, trends in authorship and collaboration research core journals, author's productivity, obsolescence and scattering of literature. This study is helpful in management of scientific literature measuring the utility of periodicals and relationship between journals and subject area and also in knowing the most productive contribution in a given field. The authorship pattern, one of prime aspects of Bibliometric analysis mainly deals with the kind of authors, nature and degree of collaboration among them and collaborative trend of authors. So the present study will help the librarians in the selection of literature in the field of "Research Analytics and Programming Tools" precisely.

## 02. Definitional Analysis: 2.1 Bibliometric:

**Hulme (1923)** "The purpose of statistical bibliography is to shed light on the process of written communication and to the nature and course of development of a discipline by means of counting and analysis its various facets of written communication.

**Raising (1962)** "The assembling and interpretation of statistical relating to books and periodicals to demonstrate historical movements, to determine national and universal research, use of books and journals and to ascertain in many local situations the general use of books and journals,"

**2.2 Scientometrics:** Scientometrics is the newly emerging field that investigates quantitative aspects of science, it is the quantitative arm of the science of science, scientific communication, studies and science policy studies (Conference Report from Library Hi Tech News, 2001). Many types of scientometrics data can be presented as transaction matrix.

**Nalimov and Mulchenk (1969)** "Scientometrics is the investigation of science as development of information process".

**Bankapur, M.B. and Kumabar, (1993)** "Scientometrics is a more general that Bibliometrics. It is interesting to know, that both disciplines have a large overlap. It is surprised to learn certain comments stating that both disciplines have a large overlap. It is surprised to learn certain comments stating that Scientometrics, using Bibliometrics techniques id a part of Bibliometrics"

## 3. Research Analytics & Programing Tools:-

This paper describes preliminary results of research related to programming tools. This study focuses on the key issues being highlighted in this research. Research in this domain should not be limited to programming introduction level, and more research is required to synthesize the current study in educational programming and to explore educational technology such as distributed line environment and mobile learning (Judy et al, 2009). Programming consists of three main components: program, programming tools and programming language. As one of the key element in programming, programming tools play an important role in programming development and implementation.

Programming tools provide the software or environment that allows programmers to give instructions, test them and implement the program. Ability and skills to use programming tools are considered as important and equivalent to skills in syntax and logic. In teaching and learning of programming, programming tools is one of the main topics that discuss issues related to pedagogy, curriculum and programming languages (Janet C. et al, 2011; Anorld, 2007; Judy, 2009). Program software developers are generally designed to meet the needs of professional and advance programmers. Usually, the software are equipped with complete set of concepts and complex functions. Each innovation considers the features of the latest gadgets that have gained importance in the computer science education community.

## 3.1 Web of Science

Web of Science (WoS) is the world's oldest, most widely used and authoritative database of research publications and citations. Web of Science, previously known as Web of Knowledge, is a database of bibliographic citations of multidisciplinary areas that covers the various journals of medical, scientific, and social sciences including humanities. Based on the Science Citation Index, founded by Eugene Garfield in 1964, it has expanded its selective, balanced, and complete coverage of the world's leading research to cover around 34,000 journals today. A wide range of use cases are supported by WoS from daily search and discovery by researchers worldwide through to the supply of analytical datasets and the provision of specialized access to raw data for bibliometric partners. A long- and well-established network of such partners enables the Institute for Scientific Information (ISI) to continue to work closely with bibliometric groups around the world to the benefit of both the community and the services that the company provides to researchers and analysts.

## 04. Methodology

Methodology means study of method or a system of methods and rule applicant to research or work. It is connected basically with what principles and technique to be follow for collecting data information and material for a given research project. (Kothari, 1990). For the present study quantitative research method is used. It is also used as a way to research in different aspects of education.

## 05. Literature Review:

*In recent years, many researchers have conducted Bibliometric analysis in different subject fields-*

Shah, Jan, Khan, and Hussain (2021) evaluate the research productivity of faculty members of Khushal Khan Khattak University Karak from 2012 to 2019. One hundred seventy-nine papers were published during the study period, out of which 48 articles (26.82%) were contributed by three personal authors, followed by four authors with 32 papers (17.88%). Dr. Saeed Ullah Jan was the most prolific author with 41 articles, followed by Dr. Anwar Khan with 40 publications. Most of the contributions (63) were made from Management Sciences and Library & Information Science (62) departments.

Agarwal and Islam (2020) examined the articles published in the "Journal of the Association for Information Science & Technology (JASIST)" from 2000-2020. It was found that more than 3,000 articles were published in the journal in which 75.73% of articles were contributed by two or more authors while 24.27% articles by single authors. Three thousand fifty-two (3,052) articles received 1, 80,608 citations during the study period and the average citations per article were 59.18. Collaboration by country reveals that the United States contributed nearly 40% of the authors and ranked first, followed by the United Kingdom with 8% authorship shares.

Gaikwad Deepa N. and Khaparde Vaishali .S. (2019) were studied in scientometric analysis on mapping of plagiarism research output in India. The Study analysed the plagiarism research performance of India in national as well as global Context, Focused on geographical distribution that the most of the publication are from USA with 19.32% the study explained that the solo Research is predominant than the collaborative research and the degree of collaboration is 0.87 also shows that the Relative growth rate [R (A) is (0.346) while the Doubling time DT (A) gradually increased from (1.548) that shows rate of publication was decreased, the Doubling time was increased.

Dongare Sudesh N. and Khaparde Vaishali .S. (2015) made study on Scientometric Analysis of Library Herald Journal. Focussed on geographical distribution, highly contributed authors in journal. That of the most contributions are from India with 75.49% and the rest 24.50% only from foreign sources.

Khaparde Vaishali and Fawaz Abdullah Alhamdi (2015) made study on The Electronic Library Journal: A bibliometric study (2010 to 2014). Focussed on the number of articles published per volume in each specific year, authorship patterns. Found that As DC value is more than 0.5, it is evident that multiple authored articles occupy the prominent position indicating the supremacy of solo research in the "The Electronic Library".

**06. Objectives of the Study: -** *According to the specific field Like Year, Authorship, Journal wise distribution etc. objectives of the study categorized are as follows-*

1. To estimate the Annual Growth rate (AGR) of publication.
2. To study the No. of journals wise distribution of publication.
3. To Analyze the Bradford law (No of Journal) of contribution.
4. To study Authorship distributions of Publications
5. To Estimate the Pareto's 80/20 Principle
6. To study Authorship Pattern Distribution - Lotka's law (No. of authors)
7. To distributing Authorship Productivity (AAPP)
8. To find out country-wise distribution of publication
9. To find out ZIPF's Law of Word Occurrence.
10. To estimate Document form of Distribution of publication.
11. To Find out Publisher wise distribution of contribution.

**07. Hypothesis of the Study:** The following hypotheses are formulated for the present study:

1) USA is the high productive country.
2) Research Articles are major source of data.

**08. Scope and Limitation of the Study:** The present study is based on Bibliometric study. The scope of the present study is limited to the 143 articles covered on 'Research Analytics and Programming Tools' on Web of Sciene Database during the total ten years i.e. (2012-2021).

**09. Data Collection:** The list of Articles on Research Analytics and Programming Tools were collected from the web of science Database the latest 10 Years from 2012-2021 with adequate details such as applied Bibliometrics Laws i.e. Lotka's law, Bradford law, ZIPF's law and also Estimate Relative Growth rate, Doubling Time (RGR & DT) various other analysis done on basis upon data collected. These have been classified grouped and analysed to find the various dimensions of the study.

**10. Data Analysis:** The analysis will be done as per the parameters laid down in the objectives of the study. The data collection & analysis is done for Research Analytics and Programming Tools a Bibliometric study of total 142 articles was collected & was analysed as per the objective laid down as well as by using various statistical tools.

*According to the objective of the study, analysis & findings of the study are outline below:*
**1. Annual Growth Rate (AGR) wise distribution**
The growth rate is a measurement which is essential in any field. In meaning the growth of the number of publications in a particular discipline. This is often a measure of the annual increase or decrease. Here, the AGR has been determined as per the formula given below:-

$$AGR = \text{(End value – First value) / (First Value) X 100}$$

**Table No. 1. - Annual Growth Rate Wise Distribution**

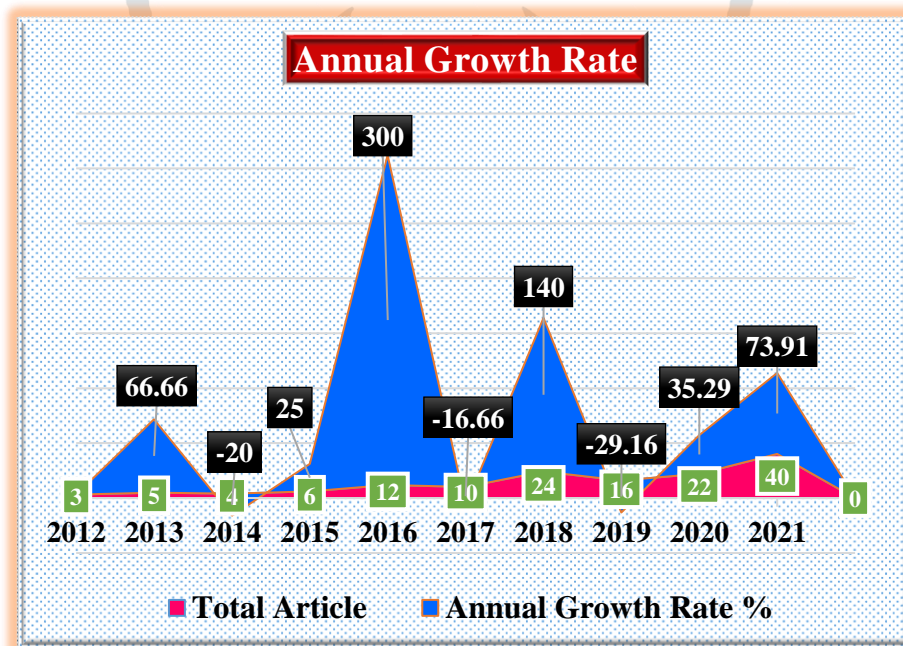| Sr. No. | Year | Frequency | Annual Growth Rate % |
|---------|------|-----------|----------------------|
| 1 | 2012 | 3 | |
| 2 | 2013 | 5 | 66.66 |
| 3 | 2014 | 4 | -20 |
| 4 | 2015 | 6 | 25 |
| 5 | 2016 | 12 | 300 |
| 6 | 2017 | 10 | -16.66 |
| 7 | 2018 | 24 | 140 |
| 8 | 2019 | 16 | -29.16 |
| 9 | 2020 | 22 | 35.29 |
| 10 | 2021 | 40 | 73.91 |



**Figure No.01 Annual Growth Rate of Publication**

In this Table 1. & Figure No.01 Describe the Annual growth rate of each year according to published paper during particular year. This table revels that the AGR of 2013 is 66.66 followed by 2014 are -20 & in the year 2015 with 25 are indicated & so on.

**2. Journal Wise Distribution of Publication**

In the present era, journals play an important role in scientific communication of current information. Articles published in journals provide nascent micro thoughts to the researchers. The present study is therefore meant

to identify the most important journals, constituting the most of the literature of research value in the field of "Research analytics & programming tools". In order to determine the ranking of journals the Articles were grouped according to the name of journals. The ranking of journals is essentially a practical tool designed to help the librarian and research scientist to select the journals of maximum utility in relation to their coverage of new and important literature in particular subject area .The ranking of journals is shown in the table no.02

**Table No - 02 Journal -Wise Distribution of contributions**

| Sr. No. | Journal Name | Total Articles | Percentage% |
|---|---|---|---|
| 1 | INTERFACES | 4 | 2.82 |
| 2 | IEEE ACCESS | 4 | 2.82 |
| 3 | JOURNAL OF THE AMERICAN MEDICAL INFORMATICS ASSOCIATION | 3 | 2.11 |
| 4 | PLOS ONE | 3 | 2.11 |
| 5 | SUSTAINABILITY | 3 | 2.11 |
| 6 | COMPUTER APPLICATIONS IN ENGINEERING EDUCATION | 2 | 1.41 |
| 7 | COMPUTERS IN HUMAN BEHAVIOR | 2 | 1.41 |
| 8 | EDUCATION AND INFORMATION TECHNOLOGIES | 2 | 1.41 |
| 9 | EUROPEAN JOURNAL OF OPERATIONAL RESEARCH | 2 | 1.41 |
| 10 | INTERNATIONAL JOURNAL OF MEDICAL INFORMATICS | 2 | 1.41 |
| 11 | JMIR MENTAL HEALTH | 2 | 1.41 |
| 12 | JOURNAL OF ANIMAL SCIENCE | 2 | 1.41 |
| 13 | JOURNAL OF CHEMICAL INFORMATION AND MODELING | 2 | 1.41 |
| 14 | PROCEEDINGS OF THE VLDB ENDOWMENT | 2 | 1.41 |
| 15 | One time Journals (1*107=107) | 107 | 75.35 |
| | **Total** | **142** | **100** |

The journals are most preferred publication used by the researcher in their Study. It may be revealed that the authors are more than likely to publish their work in different journals with their respective subject areas/disciplines. In the collected data, Observed that the "Interfaces" & "IEEE Access" scores the top position with 4(2.82%) & second rank goes to "Journal of the American Medical Informatics Association", PLOS ONE and Sustainability journal with 3 (2.14%) articles One Time Journals with 107(75.35) Journals respectively.

## 03. Bradford law (No. of journals) -Wise Distribution of contribution

Bradford's law states that "If scientific journals are arranged in decreasing productivity of articles on a given subject, they may be divided into a nucleus of periodicals more particularly devoted to subject and several zones of groups containing the same number of articles as the nucleus, then the zone will be as, 1: n: n2.

**Table No 03. Bradford law (No. of journals) -Wise Distribution of contribution**

| Bradford law (Number of journals) | | | | |
|---|---|---|---|---|
| **Zone** | **No. of Journal** | **% of Journal** | **No. of Article** | **% of Article** |
| First | 26 | 11.82 | 47.33 | 33.33 |
| Second | 73 | 33.18 | 47.33 | 33.33 |
| Third | 121 | 55 | 47.33 | 33.33 |
| **Total** | **220** | **100** | **141.99** | **100** |

The total numbers of journal articles were grouped into 3 equal zones producing similar number of articles, i.e. 47.33 articles in each zone. It can be observed from table no.3. The No. of journals & No. of Articles in 3 equal zones. The first zone 26 (No. of Article 47.33), Second zone 73 (No. of Article 47.33), Third zone 121(No. of Article 47.33) each published journals.

## 04- Pareto's 80/20 Principle

In 1906, Italian economist Vilfredo Pareto created a mathematical formula to describe the unequal distribution of wealth in his country, observing that twenty percent of the people owned eighty percent of the wealth. In the 1940s, Dr. Joseph M. Juran inaccurately attributed the 80/20 rule to Pareto, calling it Pareto's Principle.More generally, the pareto Principles is the observation (Not Law) that most things in life are not distribution evenly. It can mean all of the following things:  20% of the input creates 80% of the result

20% of the workers produce 80% of the result

20% of the customers create 80% of the revenue, 20% of the bugs because 80% of the crashes, 20% of the features cause 80% of the usage and so on.

We must remember that idea: The numbers 20 and 80 must add to 100 – they don't! 20% of the workers could create 10% of the result, or 50%. Or 80% or 99%, or even 100%. Think about it- in a group of 100 workers, 20 could do all the work while the other 80 goofs off. In that case, 20% of the workers did 100% of the work. Remember that the 80/20 rule is a rough guide about typical distributions.

**Table No.04 - Authorship & Pareto 80/20 Principle Distribution**

| Sr. No. | Authorship | Total Contributions | Cumulative % |
|---|---|---|---|
| 1 | Single Authorship | 16 | 11.27 |
| 2 | Two Times Author | 17 | 23.24 |
| 3 | Three Times Author | 24 | 40.14 |
| 4 | Four Times Author | 19 | 53.52 |
| 5 | Five Times Author | 19 | 66.90 |
| 6 | Six Times Author | 9 | 73.24 |
| 7 | Seven Times Author | 17 | 85.21 |

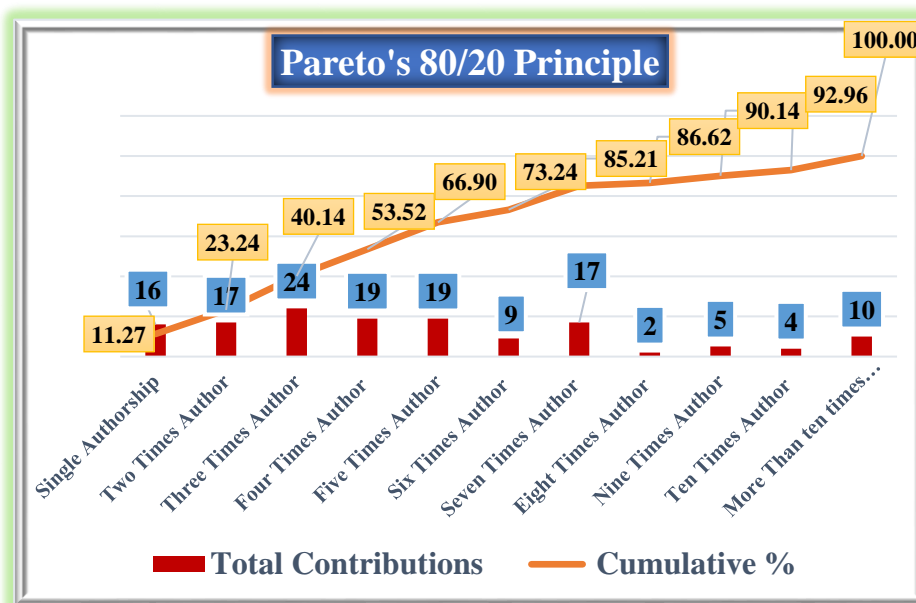| 8 | Eight Times Author | 2 | 86.62 |
|---|---|---|---|
| 9 | Nine Times Author | 5 | 90.14 |
| 10 | Ten Times Author | 4 | 92.96 |
| 11 | More Than ten times Author | 10 | 100.00 |



**Figure no – 02 Pareto 80/20 Principle Distribution**

In short, 80/20 principle states that 20% of source account for 80% of items and vice-versa i.e. other 80% of sources account for the rest 20% of items. This implies that the numbers of items are much more than the number of sources. In bibliometric/Informetric context, 20% of holdings account for 80% of circulation of library books, 20% of authors account for 80% of publication, etc.

      It is observed form the above table no - 4 and figure No -02. that, the of single authors have Written 11.27 % total publication, two authors written 23.24, followed by Three authors 40.14, Four authors 53.52 & others authors respectively, i.e. more than ten times is 100.00 that it should be in increasing order.

## 5. Lotka's law (No.of Author)

*Generally lotka's law describe the frequency of publication by authors in a given subject/discipline.*

**Table 05. Lotka's law (No. of Author)**

| X (no. of authors) | Y (no. of Publication) | Log of X | Log of Y | XY | X2 |
|---|---|---|---|---|---|
| 1 | 16 | 0.00 | 1.20 | 0.00 | 0.00 |
| 2 | 17 | 0.30 | 1.23 | 0.37 | 0.09 |
| 3 | 24 | 0.48 | 1.38 | 0.66 | 0.23 |
| 4 | 19 | 0.60 | 1.28 | 0.77 | 0.36 |
| 5 | 19 | 0.70 | 1.28 | 0.89 | 0.49 |
| 6 | 9 | 0.78 | 0.95 | 0.74 | 0.61 |
| 7 | 17 | 0.85 | 1.23 | 1.04 | 0.71 |
| 8 | 2 | 0.90 | 0.30 | 0.27 | 0.82 |
| 9 | 5 | 0.95 | 0.70 | 0.67 | 0.91 |

Identifies the distribution of articles according to the number of contributors. The highest number of three authors is accounts for 24 (16.90%) and the number of Eight times authors is the lowest and it accounts for 02 (1.41%) and Single authors accounts 16 (11.27%). Where, Collaborative Research is Predominant than Solo Research.
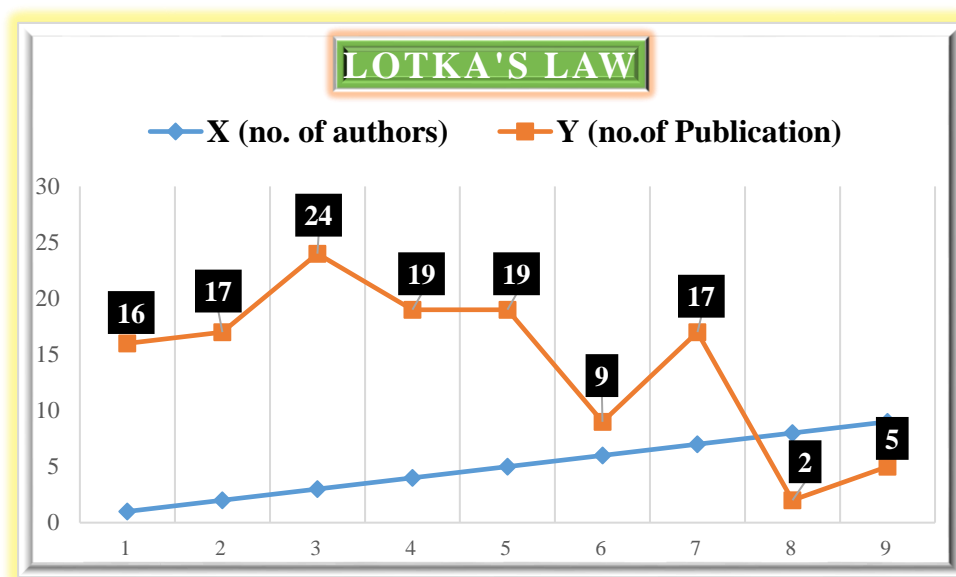


**Figure No-03 Lotka's law (No. of Author)**

## 6. To study the Author's Productivity

**Table No – 6 Author Productivity**

| Sr. No. | Year | No. of Articles | No. of Author | AAPP | PPA |
|---|---|---|---|---|---|
| 1 | 2012 | 3 | 9 | 3.00 | 0.33 |
| 2 | 2013 | 5 | 15 | 3.00 | 0.33 |
| 3 | 2014 | 4 | 25 | 6.25 | 0.16 |
| 4 | 2015 | 6 | 11 | 1.83 | 0.55 |
| 5 | 2016 | 12 | 57 | 4.75 | 0.21 |
| 6 | 2017 | 10 | 72 | 7.20 | 0.14 |
| 7 | 2018 | 24 | 118 | 4.92 | 0.20 |
| 8 | 2019 | 16 | 88 | 5.50 | 0.18 |
| 9 | 2020 | 22 | 116 | 5.27 | 0.19 |
| 10 | 2021 | 40 | 195 | 4.88 | 0.21 |
| | | **142** | **706** | **46.60** | **2.50** |

The data pertaining to author productivity has presented in the Table No.4.9 & Figure 06 shows that the total average number of authors per paper is 59.50 for the relatively equal average number of authors per article when compared the total average number of authors per article. The average productivity per author is 1.70 during the year 2009– 2018. Productivity has been calculated with the following formula.

**Average Authors per Paper** = No. of Authors / No. of Papers

**Productivity per Author** = No. of Papers / No. of Authors

**Figure No.04 Author Productivity**



## 7. Relative Growth Rate (RGR) and Doubling Timing (DT) of Articles

**Table No – 07 (RGR) and (DT)**

| Year | Frequency | Cumulative Frequency | W1 | W2 | RGR | Mean[R(A)] | DT(A) | Mean DT(A) |
|------|-----------|----------------------|------|------|------|------------|-------|------------|
| 2012 | 3 | 3 | | 1.09 | | | | |
| 2013 | 5 | 8 | 1.09 | 2.07 | 0.98 | | 0.71 | |
| 2014 | 4 | 12 | 2.07 | 2.48 | 0.41 | | 1.69 | |
| 2015 | 6 | 18 | 2.48 | 2.89 | 0.41 | 0.46 | 1.69 | 1.09 |
| 2016 | 12 | 30 | 2.89 | 3.4 | 0.51 | | 1.36 | |
| 2017 | 10 | 40 | 3.4 | 3.68 | 0.28 | | 2.48 | |
| 2018 | 24 | 64 | 3.68 | 4.15 | 0.47 | | 1.47 | |
| 2019 | 16 | 80 | 4.15 | 4.38 | 0.23 | 0.31 | 3.01 | 2.39 |
| 2020 | 22 | 102 | 4.38 | 4.62 | 0.24 | | 2.89 | |
| 2021 | 40 | 142 | 4.62 | 4.95 | 0.33 | | 2.10 | |

Table No – 07 it noticed that the mean relative growth for the first five years 2012 to 2016 is (0.46), and the mean relative growth rate for the last five years 2017 to 2021 reduced to (0.31). While the Doubling time for different years [DT (p)] gradually increased from (1.09) in 2012 to (2.24) in 2016. The mean doubling time for the first five years (i.e. 2009 to 2013) is only (1.09) which is increased to (2.39) during the last five years (2017 to 2021). Thus as the rate of growth of Articles was decreased, the corresponding Doubling Time was increased.

**8. Table No. – Country Wise Distribution of publication**

| Sr. No. | Geographical Regions | Frequency | Percentage% |
|---|---|---|---|
| 1 | USA | 56 | 39.44 |
| 2 | Spain | 12 | 8.45 |
| 3 | Australia | 8 | 5.63 |
| 4 | UK | 8 | 5.63 |
| 5 | Canada | 6 | 4.23 |
| 6 | China | 5 | 3.52 |
| 7 | Taiwan | 4 | 2.82 |
| 8 | Sweden | 4 | 2.82 |
| 9 | South Korea | 4 | 2.82 |
| 10 | India | 3 | 2.11 |
| 11 | Greece | 3 | 2.11 |
| 12 | Finland | 3 | 2.11 |
| 13 | Italy | 2 | 1.41 |
| 14 | Netherland | 2 | 1.41 |
| 15 | Germany | 2 | 1.41 |
| 16 | One time Country (1*15=15) | 15 | 10.56 |
| 17 | NA | 5 | 3.52 |
| | **Total** | **142** | **100** |

Certain countries give more research output in a particular subject than others. This is very much useful not only for the information manager in finalizing the subscription list of periodicals but also for the research scholars as they tend to know the countries that are leaders in their respective field of research.

The study regarding the country wise distributions has been done in order to know the most dominant countries in which the information is available.

Table No 8 reveals that USA with 56 (39.44%), Spain 12 (8.45%) followed by Australia and UK particularly 8(5.63%), then Canada 6 (4.23%) as per as follows in table & Geographical Maps. However in 5 (3.52%) countries place of publication is not mentioned. **Where in which Hypothesis No.01 is valid, "Majority of the contributions are contributed by USA" in Table no, 8. And Figure no.05.**

**Figure No.05- Geographical Regions**
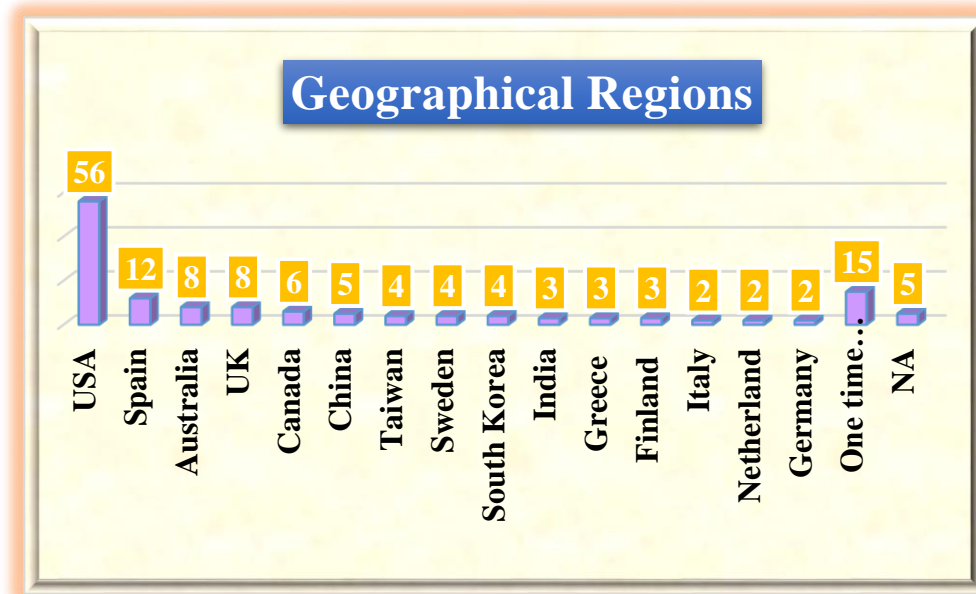


## 9. Zipf's Law of Word Occurrence

This law states that, "in a long textual matter if words are arranged in their decreasing order of frequency, then the rank of any given word of the text will be inversely proportional to the frequency of occurrence of the world" i.e. ral/f {where V' is rank and '/' is frequency) rf = c (where, c is constant) Taking log on both the sides, Log (f) + log (r) = log c Or log (f) + log (r) = c {where, c is constant) To apply this law, the words (terms) were collected from the title of the articles and ranked according to their frequency of occurrence in decreasing order. Only those words occupying frequency up to 50 items are given in Table 4.24. On applying this law, it was found that log of frequency of occurrence of words when added to log of their rank; the results are almost same for each word.

### Table 9. ZIPF's LAW OF WORD OCCURRENCE

| Sr. No. | Keywords | Frequency | Rank | Log c |
|---------|----------|-----------|------|-------|
| 1 | System | 16 | 1 | 1.204 |
| 2 | Analytics | 13 | 2 | 1.415 |
| 3 | Big Data | 13 | 3 | 1.591 |
| 4 | Program | 9 | 4 | 1.556 |
| 5 | Tools | 8 | 5 | 1.602 |
| 6 | Management | 7 | 6 | 1.623 |
| 7 | Risk | 6 | 7 | 1.623 |
| 8 | Health | 6 | 8 | 1.681 |
| 9 | Technology | 6 | 9 | 1.732 |
| 10 | Design | 5 | 10 | 1.699 |
| 11 | Education | 5 | 11 | 1.740 |

The log of frequency of three most potent words appeared in the titles "Research Analytics & Programming Tools" is given below:

**Word 1 - System**

Frequency – 16, Rank- 1

Log of frequency + log of rank =Log 16 + log 1 = 1.204 + 0 = 1.204=1.204 word

**Word 2 –** Analytics

Frequency: 13, Rank: 2

Log of frequency + log of rank = Log 13 + log 2 = 1.113+ 0.301= 1.415word

**Thus, it is proved that Zipf s law is valid even today**.

## 10. Form wise distribution of article

**Table N0 – 10 Form wise distribution of article**

| Sr. No. | Document Type | Frequency | Percentage% |
|---|---|---|---|
| 1 | Article | 115 | 80.99 |
| 2 | Review | 15 | 10.56 |
| 3 | Phenomenology | 5 | 3.52 |
| 4 | Book Chapter | 3 | 2.11 |
| 5 | Editorial Material | 2 | 1.41 |
| 6 | NA | 2 | 1.41 |
| | **Total** | **142** | **100** |

The main objective of this analysis is to know the forms in which the literature on this particular subject is being published. This study helps the information scientists/librarians in knowing the most productive form of literature on the subject. The distribution of all publications among different forms are presented in table no. 10 the highest 115 (80.99%) number of publication has been published in research article followed by Reviews with 15 (10.56%) publications, Phenomenology with 5(3.52%), and so on presented in this Table. **Hence the Hypothesis, "Research articles are the major source used in maximum" (Hypothesis No. 2) is Valid.**

## 11. Publisher wise distribution of Article

**Table No. 11 Publisher wise distribution of Article**

| Sr. No. | Publishers Name | Frequency | Percentage % |
|---|---|---|---|
| 1 | SPRINGER | 21 | 14.79 |
| 2 | ELSEVIER | 20 | 14.08 |
| 3 | WILEY | 8 | 5.63 |
| 4 | MDPI | 7 | 4.93 |
| 5 | OXFORD UNIV PRESS INC | 6 | 4.23 |
| 6 | BMC | 5 | 3.52 |
| 7 | EMERALD GROUP PUBLISHING LTD | 5 | 3.52 |
| 8 | PERGAMON-ELSEVIER SCIENCE LTD | 5 | 3.52 |

| 9 | IEEE-INST ELECTRICAL ELECTRONICS ENGINEERS INC | 4 | 2.82 |
|---|---|---|---|
| 10 | INFORMS | 4 | 2.82 |
| 11 | Three Time Publishers (3*6=18 | 18 | 12.68 |
| 12 | Two Times Publishers(2*6=12) | 12 | 8.45 |
| 13 | One Time Publisher(1*27=27) | 27 | 19.01 |
| | **Total** | **142** | **100** |

Table no 11 reveals the publisher distribution of paper, it can be observed from this Table are highest publisher Springer Publication with 21 (14.79%) then Elesvier 20 (14.08%) followed by Wiley with 8 (5.63%) one time publishers are 27 (19.01%) publications respectively.

**Conclusion:**

The objective of this paper is to identify the direction of recent research in programming tools usage in teaching and learning from 2012 to 2021. They indicate prominent issues addressed by researchers such as the techniques and methods of programming teaching, learning and assessment. Begin to develop abilities to use data to describe program operations and/or practices. This study focuses on Research Technique and programming tool and uses review analysis to determine important issues raised by recent research conducted on this topic. These tools play important role for enriching students learning experience on the learned subject. This study explore to identify and articulate trends and patterns in data gathered over time, To provide information to program staff from a variety of different backgrounds and levels of prior experience.

In programming teaching and learning, various electronic tools are available. These electronic tools are essential since programming software and environment are closely related to and require computer as a platform to implement and test the syntax of programming. Programming process involves a combination of activities i.e. planning, designing, testing and debugging. To learn on how to develop a program, researcher need to understand the syntax of programming language. Although programming teaching and learning research has rapidly increased, there is little study to evaluate and synthesize the results of relevant research in this area, specifically within the context of programming tools. These findings are useful for researchers to continue research in programming teaching tools in regard to this aspect.

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