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Collaboration trend in Speech, Language and Hearing Sciences: A Scientometric Study Based on Select Journals

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ABSTRACT

Collaboration trend among researchers can take many forms. One of the most tangible forms of this collaboration is co-authorship. Over the decades the multiple-author publication, frequently referred to as a co-authored publication, has been used as a basic counting unit to measure collaborative activity. In order to identify the collaborative trend in speech, language and hearing science three leading journals such as Journal of Speech, Language and Hearing Research(JSLRH), published by American Speech and Hearing Association (ASHA),Asia Pacific Journal of Speech, Language and Hearing(SLH) and Journal of the All India Institute of Speech and Hearing (JAIISH). A total of 905 articles published in these three journals during the period of 2009-2013 have been considered for the study. Scientometric tools such as Authorship pattern Collaborative Author Index, Degree of Collaboration. Collaboration Index, Collaborative Coefficient and Modified Collaborative Coefficient, Local collaborative index, Domestic collaborative index, International collaborative Index were used. The study shows that there exists collaborative research in speech, language and hearing sciences journals irrespective of the origin of the journal. The local collaboration of authors was more rather than domestic and international collaboration among the authors. The study also shows that there is no significant difference in collaboration in the domain of speech or language or hearing and Local collaboration persist in the domain of speech or language or hearing.

Keywords: Collaboration Trend, Local,domestic and international collaboration, Scientometric study, Scientometric tools, Author collaboration.

1. INTRODUCTION

Collaborations among researchers can take many forms. In a sense, there is a continuum ranging from the classic partnership between two faculty members at academic institutions, to situations such as the use by one researcher of another's resources such as a piece of equipment, a biological strain, or a database. Collaborators have expectations as to what the nature of the research relationship should be, including the rights and responsibilities of each party. Sometimes, the term "collaboration" may have different meanings to the collaborators and others who may be directly or indirectly involved. If these differences are not identified early in the relationship, and resolved through clear communication, they can become contentious when researchers' interpretations vary concerning emerging issues such as the access to and use of the data generated, or the ownership of intellectual property.

The result of this collaboration is that in order to complete their research, many scientists collaborate with their peers in other organization, disciplines, and even other countries.[1] One of the most tangible forms of this collaboration is co-authorship [2]. For decades the multiple-author publication, frequently referred to as a co-authored publication, has been used as a basic counting unit to measure collaborative activity.

2. SCIENTOMETRIC STUDY

Traditionally, bibliometrics have dealt with the study of print-based literature while scientometrics has focused on the statistical analysis of research pattern. The term 'Scientometrics', often used synonymously as 'Bibliometrics', which originated in Russia, is quantitative methods of application in measuring science. The measurement involves counting artefacts to the production and use of information, and arriving conclusions from the counts. The terms like 'Librametrics', 'Bibliometrics', 'Informetrics' and 'Scientometrics' have been used synonymously in order to study the growth of literature in a discipline and other aspects of literature quantitatively.

Scientometrics analyses, the quantitative aspects of science, the quantitative of the Science of Science, of Scientific Communication Studies and of Science Policy Studies. Scientometrics and Informetrics are bound through their mutual interest in scientific literature. Their statistical and mathematical orientation does not preclude analysis by qualitative methods.

3. REVIEW OF RELATED STUDIES

Newman (2004)[3] believes that useful and effective sharing of viewpoints, specialization of scientific disciplines, multi-discipline studies, increasing of research costs, and political factors all played important roles in increasing the level of collaboration between researchers.

Ardanuy (2011)[4] studied the level of co-authorship of Spanish research in Library and Information Science until 2009 and found that 46% of papers were published in collaboration within the same institution. Increasing trends were identified in articles with two and three authors. The authorship pattern is consistent with a trend of increasing multiauthorship, which has been identified in previous studies.

A review of the previous studies shows a low collaboration rate between researchers in library and information science discipline where many articles follow a single author pattern. This is in contrast with the scientific collaboration between researchers in Physics, Biology, and Astronomy. [Lee, Melin G Postdoc, Morrison, Osareh][5-7]

Despite the limitations of co-authorship measures, many studies have used this technique to investigate collaboration. For example, de Solla Price was an early advocate of the use of multiple-author papers as a measure of changes in collaboration. He produced evidence to support Smith's observation that multiple-authorship has been increasing a trend since confirmed by several other investigators[Balog,D.Deb.D deB, D Deb [8-13] However, such studies have also shown that the rate of increase in multiple-authorship has varied considerably with subject area[14,15], and in a few cases (e.g. biomedicine [16]) there seems to have been no significant growth.

4. SCIENTOMETRIC TOOLS

In this study, scientific collaboration has been measured as follows:

Collaboration Index (CI)

The simplest of the indices presently employed in the literature is the Collaboration Index, CI, which is to be interpreted merely as the mean number of authors per paper.

$$CI = \frac{\sum_{j=1}^{A} jf_j}{N}$$

j is the number of co-authored papers appearing in a discipline; N is the total number of papers in the discipline over the same time interval, and k the greatest number of authors per paper in a discipline. As pointed out by Ajiferuke et al (1988)[17] this is to be interpreted merely as a mean, for in the absence of an upper limit there is no way of interpreting the numbers generated, and secondly the method imputed a nonzero weight to single authored papers. To overcome this index referred to as the degree of collaboration is introduced, where single-author papers have zero-weight.

Degree of Collaboration (DC)

Subramaniyam (1983)[18] proposed a mathematical formula for calculating author's degree of collaboration in a discipline. The degree of collaboration among authors is the ratio of the number of collaborative publications in the total number of publications published in a discipline during certain period of time. The values of degree of collaboration can be calculated both for publications and citations. It is expressed mathematically as:

$$DC = \frac{N_m}{N_m + N_s}$$

Where

g = Group Coefficient of a discipline
N_m = Number of multiple authors during a specific period in a discipline
Ns = Number of single authored works in a discipline during a given period of time.

Collaborative Coefficient (CC)

The index CC given to overcomes the disadvantages of collaborative index and makes it possible to draw a comparison between different sub-disciplines. In order to make a relevant comparison, consider the collaboration coefficient. The patterns of co-authorship among different countries have been examined by making use of Collaborative Coefficient (CC) suggested by Ajiferuke et al (1988)[17]. The formula used for calculating CC is given below:

$$CC = 1 - \left[\sum_{j=1}^{k} (1/j) Fj / N \right]$$

Where as

Fj = the number of authored papers
N = total number of research published; and
K = the greatest number of authors per paper

Modified Collaborative Coefficient (MCC)

It is lightly modified that the new measure is almost the same as that of CC, as given in Ajiferuke et al (1988)[17]. Consider that every paper takes with it a single "credit", and this credit is being shared with the collaborated authors. Thus if a paper has a single author, the author receives one credit; similarly with 2 authors, each author receives 1/2 credits and, in general, if a publication has X authors, each receives 1=X credits (it was the same as that of the idea of fractional productivity defined by Price and Beaver[19] as the score of an author when he is assigned 1=n of a unit for one item for which n authors have been credited.)

Hence, the average credit awarded to each author of a random paper is E[1=X], a value that lies between 0 and 1. Since the value 0 is corresponding to single authorship, it can be defined as the Modified Collaborative Coefficient (MCC).

$$MCC = \frac{A}{A-1}\left\{1 - \frac{\sum_{j=1}^{A}(1/j)f_j}{N}\right\}$$

Where as

A = Total number of papers of particular year
N = All total number of authors in collection
J = the collaboration of number of authors like two, three, four etc.
f_j = all the authors in the collaboration

Co-authorship Index (CAI) has been obtained by calculating proportional output of single, two, three and multi-authored papers for different journals and for different sub-specialties of speech, language and hearing sciences. The methodology is similar to one suggested by Price[20] and used to calculate Activity Index (AI) suggested by Frame[21] and elaborated by Schubert and Braun[22].

Here **CAI = {(Nij / Nio) / (Noj / Noo)}×100** where
Nij = Number of papers having j-authors from journal i,
Nio = Total output of journal i,
Noj = Number of papers having j-authors from all the three journals,
Noo = Total output for all journals and j = 1,2,3, and (≥4). Here 'all' implies all the 3 identified journals.

CAI = 100 implies that a journal's co-authorship effort for a particular type of authorship corresponds to the world average, CAI > 100 reflects higher than average co-authorship effort, and CAI < 100 lower than average co-authorship effort by that journal for a given type of authorship pattern. The measure is different than what has been suggested by Garg and Pathi [23]. For calculating the co-authorship index for different sub-specialties of speech, language and hearing sciences, journals have been replaced by sub-specialty.

Local Collaborative Index (LCI) has been obtained by calculating proportional output of domestically co-authored papers.

Here ***LCI = {(Li / Lio) / (Lo / Loo)}× 100*** where
Li = Number of domestically co-authored papers for journal i,
Lio = Total output for journal i,
Lo = Number of domestically co-authored papers from all journals,
Loo = Total output for all journals. Here 'all' implies all the 3 identified journals.

Domestic Collaborative Index (DCI) has been obtained by calculating proportional output of domestically co-authored papers.

Here **DCI = {(Di / Dio) / (Do / Doo)}× 100** where
Di = Number of domestically co-authored papers for journal i,
Dio = Total output for journal i,
Do = Number of domestically co-authored papers from all journals,
Doo = Total output for all journals. Here 'all' implies all the 3 identified journals.
International Collaborative Index (ICI) has been obtained by calculating proportional output of internationally co-authored papers and is an improvement over internationalization index suggested by Nagpaul[24].

Here **ICI = {(Ii / Iio) / (Io /Ioo)} ×100** where
Ii = Number of internationally co-authored papers for journal i,
Iio = Total output for journal i,
Io = Number of internationally co-authored papers for all journals,
Ioo = Total output for all journals. Here 'all' implies the 3 identified journals.

The value of DCI or ICI = 100 indicate that a country's collaborative effort corresponds to world average. DCI or ICI > 100 reflects collaboration higher than world average and DCI or ICI < 100 reflects collaboration less than world average.

5. OBJECTIVES

The objectives of the study were

- To identify the type of co-authorship pattern in general as well as in terms of its sub-specialities in the leading journals in the area of speech, language and hearing sciences during 2009 to 2013 and to calculate the co-authorship index.

- To identify the pattern and magnitude of local, domestic and international collaboration in general as well as in terms of its sub-specialities in the leading journals in the area of speech, language and hearing sciences during 2009 to 2013 and to measure the local, domestic and international collaborative index.

6. HYPOTHESES

The following hypotheses were formulated for the study.

- There exists collaborative research in speech, language and hearing sciences journals irrespective of the origin of the journal.

- There exist local collaboration rather than domestic and international collaboration.
- There is no significant difference in collaboration in the domain of speech or language or hearing.
- Local collaboration persist in the domain of speech or language or hearing.

7. DATA

Data for the present study are taken from the following leading 3 journals one each from USA, Asia and India in the area of speech, language and hearing sciences:

- ***Journal of Speech, Language and Hearing Research (JSLHR)***, published by **American Speech and Hearing Association (ASHA)**, a bimonthly, peer-reviewed journal containing basic as well as applied research in normal and disordered communication processes with topics relevant to speech-language pathology and audiology professionals worldwide.

- ***Speech, Language and Hearing (SLH),*** a peer-reviewed journal, *previously published as* ***Asia Pacific Journal of Speech, Language and Hearing,*** affiliated with the Asia Pacific Society of Speech, Language and Hearing (SLH), New Zealand Speech-Language Therapists' Association (NZSTA) and Hong Kong Association of Speech Therapists (HKAST)

- ***Journal of the All India Institute of Speech and Hearing (JAIISH***, a peer-reviewed official publication of AIISH, Mysore ,which carries articles pertaining to the normal and abnormal processes and disorders of Language, Speech and Hearing.

8. METHODOLOGY

- The above 3 journals have been identified as they are not only leading journals in the field of speech, language and hearing sciences but they also feature articles from all the three sub-specialities.
- Data for a 5 year time period is used to avoid variations in collaboration pattern.
- A count of the papers by different number of authors (say 1, 2,3….) was made. The papers by four authors and above have been clubbed together and would be termed as multiauthored papers.
- The data has been analyzed to identify local (inter- departmental), domestic (inter-institutional), and international collaboration for different nations.

9. ANALYSIS

Analysis has been carried out Journal wise, Subject wise, Authorship Pattern

9.1 Journal wise Distribution

The journal wise distribution is shown in Table 1 along with percentage. A total of 905 publications taken up for the study.

Table 1
Distribution of Publications

S. No.	Journal Name	Country	Number of Issues	Publications	Percentage	Cumulative	Cumulative Percentage
1	JAIISH	India	6	146	16.13	146	16.13
2	JSLHR	USA	12	648	71.60	794	87.73
3	SLH	Asia-Pacific	9	111	12.27	905	100.00
Total				**905**	**100**		

Out of 905 publications ,146 (16.13) publications belongs to India based journal *JAIISH*. It is followed by 648 (71.60) publications of USA based journal *JSLHR* and 111 (12.27) publications are Asia-Pacific based journal *SLH*. These 905 publications, were published over 5 year period (2009-2013). Year wise distribution of articles are shown in Table 2.

It can be seen from Table 2, that the number of papers in each year wasre around 17.68% to 22.65%. So number of papers during the 5 year period were in linear trend. Similarly for each journal, the number of papers for each year, showed a linear trend.

Table 2
Journal *Vs* Year wise Distribution of Publications

S. No.	Year	JAIISH	JSLHR	SLH	Total
		No. of Papers	No. of Papers	No. of Papers	No. of Papers
1	2009	25 (17.12)	112 (17.28)	23 (20.72)	160 (17.68)
2	2010	34 (23.29)	124 (19.14)	20 (18.02)	178 (19.67)
3	2011	28 (19.18)	119 (18.36)	23 (20.72)	170 (18.78)
4	2012	28 (19.18)	144 (22.22)	20 (18.02)	192 (21.22)
5	2013	31 (21.23)	149 (22.99)	25 (22.52)	205 (22.65)
Total		**146 (100)**	**648 (100)**	**111 (100)**	**905 (100)**

9.2 Authorship Pattern

The Authorship pattern of these articles both overall and for individual journals are shown in Table 3.

Table 3
Authorship Pattern

S. No.	No. of Authors	JAIISH	JSLHR	SLH	Total
		No. of Papers	No. of Papers	No. of Papers	No. of Papers
1	Single Author	5 (3.42)	45 (6.95)	13 (11.71)	63 (6.96)

2	Two Author	50 (34.25)	181 (27.93)	31 (27.93)	262 (28.95)
3	Three Authors	54 (36.99)	171 (26.39)	35 (31.53)	260 (28.73)
4	Four and above	37 (25.34)	251 (38.73)	32 (28.83)	320 (35.36)
Total		**146 (100)**	**648 (100)**	**111 (100)**	**905 (100)**

The overall *single author* publications works out to 63 (6.96%), followed by *two authors* 262 (28.95%), *three authors* 260 (28.73%) and *four and above* 320 (35.36%). It can be inferred that the collaborative research persist in speech, language and hearing sciences journals. In the case of JAIISH – India based journal 96.58% were collaborated research whereas in USA based journals - JSLHR 93.05% were collaborated and in the case of Asia Pacific journal – SLH, 88.29% were collaborative in nature. Further it can be seen that the Indian contributions as solo research is to the extent of 11.71%.

The CAI, thus calculated for the authorship pattern for individual journals are shown in Table 4 along with CAI in coded form i.e. if CAI >100 indicated as ++ and <100 indicated as - -.

Table 4
CAI for Authorship Pattern

S. No.	No. of Authors	JAIISH			JSLHR			SLH			Total
		No. of Papers	CAI	CAI - Coded	No. of Papers	CAI	CAI - Coded	No. of Papers	CAI	CAI - Coded	No. of Papers
1	Single Author	5	49.2	− −	45	99.78	− −	13	168.27	+ +	63
2	Two Author	50	118.3	+ +	181	96.48	− −	31	97.47	− −	262
3	Three Authors	54	128.7	+ +	171	91.85	− −	35	109.75	+ +	260
4	Four and above	37	71.67	− −	251	109.54	+ +	32	81.53	− −	320
Total		**146**			**648**			**111**			**905**

It can be seen from Table 4 from that CAI for two authors and three authors in the case of JAIISH positive in nature. Similarly in the case of JSLHR, the CAI is positive in 4 and above authors only. Similarly in the case of SLH single author and three authors are positive in nature. It can be inferred that JAIISH contains more of two and three author papers whereas ,JSLHR contains four and above authors are more. In the case of SLH, it contains single and three author papers are more, compared to two and four and above authors. The DC, CI and CC were also calculated journal wise and the same is shown in Table 5.

Table 5
DC, CI and CC

S. No.	Name of the Journal	Single Author	Two Authors	Three Authors	Four and Above Authors	Total	DC	CI	CC
1	JAIISH	5	50	54	37	146	0.97	3.10	0.62
2	JSLHR	45	181	171	251	648	0.93	3.36	0.63
3	SLH	13	31	35	32	111	0.88	3.06	0.58
Total		**63**	**262**	**260**	**320**	**905**	**0.93**	**3.28**	**0.62**

In all the three journals, the degree of collaboration is more than 93%, the collaborative index indicates that the majority of the papers were three authors. The collaborative coefficient shows that the collaboration is only 62% and it ranges between 58% and 63% in the case of individual journals. It can be also inferred that, the Indian journal as lees collaboration comparing to foreign journals.

The year wise DC. CI, CC and MCC were calculated using the formula stated above and the same is shown in Table 6.

Table 6
DC. CI, CC and MCC *Vs* Year wise

Year	Single Author	Two Authors	Three Authors	Four and Above Authors	Total	DC	CI	CC	MCC
2009	20	46	37	57	160	0.88	3.18	0.58	0.73
2010	10	49	51	68	178	0.94	3.38	0.63	0.79
2011	14	45	50	61	170	0.92	3.29	0.62	0.77
2012	11	54	63	64	192	0.94	3.27	0.63	0.78
2013	8	68	59	70	205	0.96	3.27	0.63	0.79
Total	**63**	**262**	**260**	**320**	**905**	**0.93**	**3.28**	**0.62**	**0.77**

It can be seen from table 6, the collaboration trend increases the over the period,. It can be inferred that the collaborative trend is of recent trend only from the year 2010 onwards. The modified collaborative coefficient indicates that 77% were collaboration in nature.

Further DC, CI, CC and MCC were calculated for JAIISH and the same is shown in Table 7.

Table 7
DC. CI, CC and MCC *Vs* Year wise (JAIISH)

	Single Author	Two Authors	Three Authors	Four and Above Authors	Total	DC	CI	CC	MCC
2009	2	7	13	3	25	0.92	2.80	0.58	0.73
2010	0	10	12	12	34	1.00	3.41	0.66	0.83
2011	1	7	9	11	28	0.96	3.46	0.65	0.82
2012	2	10	11	5	28	0.93	2.86	0.58	0.73
2013	0	16	9	6	31	1.00	2.87	0.61	0.76
Total	**5**	**50**	**54**	**37**	**146**	**0.97**	**3.10**	**0.62**	**0.78**

The degree of collaboration of JAIISH works out to 97% which indicates that the majority of the articles are collaborative in nature. In the year 2010 and 2013 all the papers have appeared in collaboration. The CI indicates that the average author per paper between 2 and 3 authors. Three, four and above authors paper were more during 2010 and 2011. The CC shows the inconsistency in collaboration. The MCC also indicates the same. In both the case the coefficient values were increasing over the year 2010 and slowly reduces over the years.

The DC, CI, CC and MCC were calculated for **JSLHR** and the same is shown in Table 8.

Table 8
DC. CI, CC and MCC *Vs* Year wise (JSLHR)

Year	Single Author	Two Authors	Three Authors	Four and Above Authors	Total	DC	CI	CC	MCC
2009	11	32	22	47	112	0.90	3.36	0.61	0.76
2010	9	34	31	50	124	0.93	3.39	0.63	0.78
2011	12	33	32	42	119	0.90	3.23	0.60	0.75
2012	7	39	42	56	144	0.95	3.41	0.64	0.80
2013	6	43	44	56	149	0.96	3.38	0.64	0.80
Total	**45**	**181**	**171**	**251**	**648**	**0.93**	**3.36**	**0.63**	**0.78**

The degree of collaboration of JSLHR works out to 93% which indicates that the majority of the articles are collaborative in nature. The CI indicates that the average author per paper between 3 and above. The CC shows the inconsistency in collaboration. The MCC also indicates the same. In both the case the coefficient values were increasing over the year 2010 and slowly reduces over the years.

Similarly DC, CI, CC and MCC were calculated for **SLH** and the same is shown in Table 9.

Table 9
DC. CI, CC and MCC *Vs* Year wise (SLH)

Year	Single Author	Two Authors	Three Authors	Four and Above Authors	Total	DC	CI	CC	MCC
2009	7	7	2	7	23	0.70	2.70	0.45	0.57
2010	1	5	8	6	20	0.95	3.25	0.63	0.79
2011	1	5	9	8	23	0.96	3.39	0.65	0.81
2012	2	5	10	3	20	0.90	2.85	0.58	0.72
2013	2	9	6	8	25	0.92	3.12	0.60	0.75
Total	**13**	**31**	**35**	**32**	**111**	**0.88**	**3.06**	**0.58**	**0.73**

The degree of collaboration of SLH works out to 88% which indicates that the majority of the articles are collaborative in nature. The CI indicates that the average author per paper between 2 and 3 authors. Three, four and above authors paper were more during 2010 and 2011. The CC shows the inconsistency in collaboration. The MCC also indicates the same. In both the case the coefficient values were increasing over the year 2010, 2011 and slowly reduces over the years. Further it can be inferred that SLH has less collaborated papers.

9.3 Subject Wise

In order to identify the subject wise collaboration, the number of papers in each journal on four major subjects such as Speech , Language, Hearing and Others has been identified and same is shown in Table 10.

Table 10
Journal *Vs* Subject wise Distribution of Publications

S. No.	Subject	JAIISH	JSLHR	SLH	Total
		No. of Papers	No. of Papers	No. of Papers	No. of Papers
1	Speech	56 (38.36)	238 (36.73)	40 (36.04)	334 (36.91)
2	Language	57 (39.04)	255 (39.35)	48 (43.24)	360 (39.78)
3	Hearing	32 (21.92)	150 (23.15)	12 (10.81)	194 (21.44)
4	Others	1 (0.68)	5 (0.77)	11 (9.91)	17 (1.87)
Total		**146 (100)**	**648 (100)**	**111 (100)**	**905 (100)**

36.91% of articles were on the subject Speech, it is followed by Language (39.78%) and Hearing (21.44%). Only 1.87% of the articles appeared other than the three subjects. It can be inferred that the number of articles in each subject almost proportionate. The same trend can be seen in individual journals too. However in the case of SLH nearly 10% of the articles were other than Speech, Language and Hearing subject.

Authorship pattern under each subject has been identified and the same is shown in Table 11.

Table 11
Authorship Pattern *Vs* Subject

S. No.	No. of Authors	Speech	Language	Hearing	Others	Total
		No. of Papers	No. of Papers	No. of Papers	No. of Papers	No. of Papers
1	Single Author	24 (7.25)	25 (6.87)	14 (7.25)	0 (0.00)	63 (6.96)
2	Two Author	94 (28.40)	110 (30.22)	54 (27.98)	4 (23.53)	262 (28.95)
3	Three Authors	92 (27.79)	96 (26.37)	63 (32.64)	9 (52.94)	260 (28.73)
4	Four and above	121 (36.56)	133 (36.54)	62 (32.12)	4 (23.53)	320 (35.36)
Total		**331 (100)**	**364 (100)**	**193 (100)**	**17 (100)**	**905 (100)**

In the case of *Speech subject*, out of 331 papers 24 (7.25%) belongs to *single author* paper. It is followed by 97 (28.40%) *two author paper*, 92 (27.79%) *three authors* and 121 (36.56%) *four and above author* papers. Similarly in the case of *Language subject*, out of 334 papers 25 (6.87%) belongs to *single author paper*. It is followed by 110 (30.22%) *two author paper*, 96 (26.37%) *three authors* and 133 (36.54%) *four and above author* papers. In the case of *Hearing subject*, out of 193 papers 14 (7.25%)

belongs to *single author* paper. It is followed by 54 (27.98%) *two author* paper, 63 (32.64%) *three authors* and 62 (32.12%) *four and above author* papers. Similarly in the case of *Others subject* all 17 papers were collaborative in nature. Out of 17 papers, 4 (23.53%) belongs to *two author* paper. It is followed by 9 (52.94%) *three authors* and 4 (23.53%) *four and above author* papers.

The DC, CI and CC for each subject were calculated and same is shown in Table 12.

Table 12
DC, CI and CC Vs Subject

S. No.	Subject	Single Author	Two Authors	Three Authors	Four and Above Authors	Total	DC	CI	CC
1	Speech	24	94	92	121	331	0.93	3.30	0.62
2	Language	25	110	96	133	364	0.93	3.29	0.62
3	Hearing	14	54	63	62	193	0.93	3.22	0.61
4	others	0	4	9	4	17	1.00	3.24	0.66
Total		**63**	**262**	**260**	**320**	**905**	**0.93**	**3.28**	**0.62**

The DC for all the four subjects works out to 93%. Further it can be seen from the table 12 that the DC of three subjects namely Speech, Language and Hearing were identical i.e. 93%. The CI indicates that the average author per paper on each subject ranges between 3 and 4. The CC also almost identical for the three subjects.

9.4 Collaboration Nature - Local, Domestic and International

The study further extended to nature of collaboration such as Local, Domestic and International for individual journals and overall. The same is shown in Table 13

Out of 905 papers, (366, 40.44%) were local collaboration. It is followed by domestic collaboration (344, 38.01%) and international collaboration (132, 14.59%). In the case of JAIISH out of 146 papers, 105 (71.92%) were local collaboration. It is followed by domestic collaboration (29, 19.861%) and international collaboration (7, 4.79%). As far as JAIISH is concerned, local collaboration is more since it is an Indian based publication. It is surprised to see 7 (4.79%) international collaborated papers. Similarly, JSLHR out of 648 papers, 219 (33.80%) were local collaboration. It is followed by domestic collaboration (280, 43.21%) and international collaboration (104, 16.05%). As far as JSLHR is concerned, domestic and local collaboration is more since it is an USA publication. In the case of SLH, out of 111 papers, 42 (37.84%) were local collaboration. It is followed by domestic collaboration 35 (31.53%) and international collaboration 21 (18.92%). As far as SLH is concerned, both local and domestic collaboration were evenly poised. Whereas this journal has 19% international collaboration. Of course it is interesting to note that nearly 13 (11.71%) has no collaboration.

Table 13
Nature of Collaboration

S. No.	Collaboration	JAIISH	JSLHR	SLH	Total No. of Papers
		No. of Papers	No. of Papers	No. of Papers	
1	Local	105 (71.92)	219 (33.80)	42 (37.84)	366 (40.44)
2	Domestic	29 (19.86)	280 (43.21)	35 (31.53)	344 (38.01)
3	International	7 (4.79)	104 (16.05)	21 (18.92)	132 (14.59)
4	No Collaboration	5 (3.42)	45 (6.94)	13 (11.71)	63 (6.96)
Total		**146 (100)**	**648 (100)**	**111 (100)**	**905 (100)**

The collaborative index for local, domestic and international and the same is shown in Table 14.

Table 14
LCI, DCI, ICI *Vs* Journal

S. No.	Name of the Journal	Local Collaboration Papers	Domestic Collaboration Papers	International Collaboration Papers	Local Collaboration Index	Domestic Collaboration Index	International Collaboration Index
1	JAIISH	105	29	7	178	52	33
2	JSLHR	219	280	104	84	114	110
3	SLH	42	35	21	94	83	130
Total		**366**	**344**	**132**			

It can be seen from the table 14, that local collaborative index of JAIISH is more compared to JSLHR and SLH. In the case of JSLHR, domestic collaboration index is more compared to SLH and JAIISH. The international collaboration index is more in SLH and JSLHR.

The subject wise Nature of Collaboration were identified and same is shown in Table 15. Out of 331 papers in Speech, 132 (39.88%) has local collaboration. It is followed by 120 (36.25%) papers as domestic collaboration papers and 55 (16.62%) papers as international collaboration. Similarly in the case of Language, out of 364, 147 (40.38%) has local collaboration. It is followed by 139 (38.19%) papers as domestic collaboration papers and 53 (14.56%) papers as international collaboration. In the case of Hearing ,out of 193, 83 (43.01%) has local collaboration. It is followed by 74 (38.34%) papers as domestic collaboration papers and 22 (11.40%) papers as international collaboration. In the case of Others, all the 17 papers were collaborative in nature, of which, 5 (29.41%) belongs to local collaboration. It is followed by 9 (52.94%) papers as domestic collaboration papers and 3(17.65%) papers as international collaboration. In general the local collaboration was more irrespective of the subject such as Speech,

Language and Hearing followed by domestic and international. The ratio of collaboration between international, domestic and local were 1:2.57:2.75.

Table 15
Nature of Collaboration *Vs* Subject

S. No.	Collaboration	Speech	Language	Hearing	Others	Total No. of Papers
		No. of Papers	No. of Papers	No. of Papers	No. of Papers	
1	Local	132 (39.88)	147 (40.38)	83 (43.01)	5 (29.41)	367 (40.55)
2	Domestic	120 (36.25)	139 (38.19)	74 (38.34)	9 (52.94)	342 (37.79)
3	International	55 (16.62)	53 (14.56)	22 (11.40)	3 (17.65)	133 (14.70)
4	No Collaboration	24 (7.25)	25 (6.87)	14 (7.25)	0 (0.00)	63 (6.96)
Total		**331 (100)**	**364 (100)**	**193 (100)**	**17 (100)**	**905 100)**

The local, domestic and international collaborative index for subject wise were calculated and the same is shown in Table 16.

Table 16
LCI, DCI, ICI *Vs* Subject

S. No.	Subject	Local Collaboration Papers	Domestic Collaboration Papers	International Collaboration Papers	Local Collaboration Index	Domestic Collaboration Index	International Collaboration Index
1	Speech	132	120	55	98.34	95.93	113.07
2	Language	147	139	53	99.59	101.05	99.08
3	Hearing	83	74	22	106.05	101.46	77.56
4	Others	5	9	3	72.53	140.09	120.08

In the case of Speech, international collaborative index is more compared to local and domestic collaborative index. Whereas in Language, domestic collaborative index is more compared to local and international. Similarly in the case of Hearing, local collaborative index is more, followed by domestic and international collaboration.

10. FINDINGS

The findings of the study are:

- Collaboration trend on Speech, Language and Hearing sciences has been identified using three journals namely Journal of Speech, Language and Hearing Research(JSLHR), Asia Pacific Journal of Speech, Language and Hearing (SLH) and Journal of the All India Institute of Speech and Hearing (JAIISH).
- A total of 905 articles, published in these three journals during the period of 2009-2013. The number of papers during the study period in these three journals is linear in trend.

- Single author publications works out to 63 (6.96%), it is followed by two authors 262 (28.95%), three authors 260 (28.73%) and four and above 320 (35.36%). It can be inferred that the collaborative research persist in speech, language and hearing sciences journals.
- In the case of India based journal- JAIISH, 96.58% were collaborated research whereas in USA based journal - JSLHR 93.05% were collaborated and in the case of Asia-Pacific journal – SLH, 88.29% were collaborated in nature.
- Indian contributions show solo research to the extent of 11.71%.
- In all the three journals, the degree of collaboration is more than 93%, the collaborative index indicates that the majority of the papers were three authors. The collaborative coefficient shows that the collaboration is only 62% and it ranges between 58% and 63% in the case of individual journals. It can be also inferred that, the Indian journal has less collaboration compared to foreign journals.
- The collaboration trend increases the over the period. Iit can be inferred that the collaborative trend is of recent trend only from the year 2010 onwards. The modified collaborative coefficient indicates that 77% were collaboration in nature.
- The degree of collaboration of JAIISH works out to 97% which indicates that the majority of the articles are collaborative in nature. In the year 2010 and 2013 all the papers thus appear in collaboration in nature. The average author per paper between 2 and 3 authors. Three, four and above authors paper were more during 2010 and 2011. .
- The degree of collaboration of JSLHR works out to 93% which indicates that the majority of the articles are collaborative in nature. The average author per paper between 3 and above were more during 2010 and 2011. The CC shows the inconsistency in collaboration. The MCC also indicates the same.
- The degree of collaboration of SLH works out to 88% which indicates that the majority of the articles are collaborative in nature. The CI indicates that the average author per paper between 2 and 3 authors. Three, four and above authors paper were more during 2010 and 2011. The CC shows the inconsistency in collaboration. The MCC also indicates the same. In both the case the coefficient values were increasing over the year 2010, 2011 and slowly reduces over the years. Further it can be inferred that SLH has less collaborated papers.
- 36.91% of articles were in Speech, followed by Language (39.78%) and Hearing (21.44%). Only 1.87% of the articles appeared other than the three subjects. It can be inferred that the number of articles in each subject almost proportionate. The same trend can be seen in individual journals too. However in the case of SLH, nearly 10% of the articles were other than Speech, Language and Hearing subject.
- Speech has 331 papers, 24 (7.25%) belongs to single author paper, 97 (28.40%) two author paper, 92 (27.79%) three authors and 121 (36.56%) four and above author papers. In Language, out of 334 papers, 25 (6.87%) belongs to single author paper. It is followed by 110 (30.22%) two author paper, 96 (26.37%) three authors and 133 (36.54%) four and above author papers. In Hearing , out of 193 papers, 14 (7.25%) belongs to single author paper. It is followed by 54 (27.98%) two author paper, 63 (32.64%) three authors and 62 (32.12%) four and above author papers. Other than the above three subjects there exist 17 papers, which were all collaborative in nature. Out of 17 papers, 4 (23.53%) belongs to two

author paper. It is followed by 9 (52.94%) three authors and 4 (23.53%) four and above author papers.

- Out of 905 papers, 366 (40.44%) were local collaboration, 344 (38.01%) domestic collaboration and 132 (14.59%) international collaboration.
- JAIISH has 105 (71.92%) local collaboration. 29 (19.86%) domestic collaboration and 7 (4.79%). international collaboration. In JAIISH, local collaboration is more and it is a Indian based publication. It has 7 (4.79%) international collaborated papers.
- JSLHR has 219 (33.80%) local collaboration, 280 (43.21%),domestic collaboration and 104 (16.05%) international collaboration. As far as JSLHR is concern domestic and local collaboration is more and it is USA publication.
- SLH has 42 (37.84%) local collaboration, 35 (31.53%) domestic collaboration and 21 (18.92%) international collaboration As far as SLH is concerned, both local and domestic collaboration were evenly poised. Whereas this journal has 19% international collaboration. Nearly 13 (11.71%) has no collaboration.

11. CONCLUSION

The scientometric study thus carried using the three journals viz., Journal of Speech, Language and Hearing Research), Speech, Language and Hearing and Journal of the All India Institute of Speech and Hearing for identifying the collaboration trend shows that there exists collaborative research in speech, language and hearing sciences journals irrespective of the origin of the journal. The local collaboration of authors were more rather than domestic and international collaboration among the authors. The study also shows that there is no significant difference in collaboration in the domain of speech or language or hearing and Local collaboration persist in the domain of speech or language or hearing. Only 905 papers have been studied to find the collaboration trend. Therefore the finding may be indicative in nature. Exhaustive study in this domain may **pave** way for getting accuracy in the study.

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