

## AUTHORSHIP PATTERN IN DIFFERENT DISCIPLINES

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*References appended to 92 Doctoral theses submitted to the Departments of mathematics, physics, mechanical engineering, philosophy and political science, University of Burdwan, India from 1981 to 1990 are taken as the object of study. Extent of multiple authorship, degree of authorship collaboration and their change with time are studied.*

*Within broad subjects, multiple authored articles are found to be maximum in physics (62.24%) while 36.6% of the articles in mechanical engineering, 36.3% of the articles in mathematics, 12.3% of the articles in philosophy and only 3.85% of the articles in political science are multiple authored. Within specific subjects, multiple authorship is highest in nuclear physics (72.52%). The multiple authorship trend has increased steadily through decades (1950 to 1990) in physics, mathematics and psychology. In mechanical engineering, philosophy excluding psychology and political science the multiple authorship trend has increased in the first few decades but then the trend has decreased for certain period. In mechanical engineering the multiple authorship was highest during 1951-1960. In philosophy excluding psychology, it was highest during 1971-1980 and in political science the multiple authorship was highest during 1961-1970.*

### INTRODUCTION

Multiple authorship indicates development of a subject and a tendency of inter institutional and inter disciplinary study.

According to Arora and Pawan [1], "increase in multiple authorship and collaboration between researchers is an indication of growing professionalism in different fields".

### MULTIPLE AUTHORSHIP STUDIES

There are many studies on collaborative research in different subjects. Some of the relevant studies are mentioned here.

Karisdappa, Maheswarappa and Shirol [2] studied "Authorship pattern and collaborative research in psychology" based on the data collected from 'Psychological Abstracts' for the year 1988, where 39.43% of the papers accounted for single-authorship and the degree of collaboration in psychology was 0.60.

Khaiser Jahan Begum and N Rajendra [3] studied "Research collaboration in Zoological Sciences" analysing 7854 items published during 1975-84, where 67.02% of the literature was by multiple authors.

Mujoo-Munshi, Vashishth and Gautam [4] have studied "Research collaboration in agricultural sciences" analysing about 9500 papers published during 1982-86 by six agricultural universities in India. Here 15.36% of the articles were single authored. Here, the degree of collaboration is wrongly calculated as 5.51 whereas it should be  $8129/(8129+1476)=0.85$ .

Gupta [5] has studied the authorship trend of African psychology while analysing a database of 2297 items from Psychological Abstracts in

"Structure of African psychological literature: 1927-1987".

Sen, B K [6] has studied articles with ten or more authorship. Five percent of the papers published in Proceedings of the National Academy of Science, New York, February - July 1996 were 'mega authored'.

Joshi and Maheswarappa [7] in "Multiple authorship trends in different subjects of science and technology: a review of literature" reviews the studies related to multiple authorship trends in different subjects like mathematics, astronomy, physics, chemistry, geology, paleontology, genetics, botany, zoology, engineering, agricultural sciences, chemical technology and space technology. In mathematics 94% of the papers were single-authored in 1940, 79% in 1960 and 44.23% in 1983.

Qin [8] has studied the average number of collaborators per author in biotechnology, "Collaboration and publication productivity: an experiment with a new variable in Lotka's Law". The overall average number of authors per paper was 2.69.

Raina, Gupta and Khandari [9] have worked on the evolution of collaboration in physics in India in "Collaboration in Indian Physics: a case study of the macro and micro parameterization of subdisciplines (1800-1950)".

## **OBJECTIVE**

The objective of the present paper is to make a comparative study of different subjects with respect to:

- the percentage of papers with different number of authors per article,
- the extent of multiple authorship,
- the average number of authors per article,
- the degree of authorship collaboration, and
- the trend of change in multiple authorship with time.

## **METHODOLOGY**

Ninety-two doctoral dissertations submitted to the University of Burdwan from 1981 to 1990 by the

scholars of five different Departments of science, engineering, social science and humanities, namely, mathematics, physics, mechanical engineering, philosophy and political science are taken as the source material. The references appended to them are noted as the main subject of study. Whenever a single thesis refers to a single article more than once, the duplicates are considered as one. A total number of 11,222 references were appended to the 92 theses. Subject wise distribution of the theses and their references are given elsewhere [10]. The desired analyses are made with the help of computer program developed for the purpose [11].

Degree of collaboration is the ratio of multiauthored papers published during a year and the total number of papers published during the year in a discipline [12]. This index or degree is time dependent.

## **ANALYSIS**

### ***Authors Per Article***

Table 1 gives comparative picture of percentage of papers with different number of authors per article in various subjects. Table 2 gives comparative picture of percentage of single-authored and multiauthored papers, average number of authors per article and degree of authorship collaboration in various subjects.

### ***Five or More Authors***

In physics 8.68% of the articles have five or more authors. 15.82% of the articles in nuclear physics have five or more authors. In mathematics only 0.40% of the articles have five or more authors. No other subject has any article with more than five authors. 0.8% of the articles in mechanical engineering, only 0.06% of the articles in political science and 0.05% of the articles in philosophy are five authored.

### ***Four Authors***

Four authored articles are not very scarce as 7% of the articles in physics, 0.93% in mathematics, 0.4% in mechanical engineering, 0.26% in philosophy and 0.1% of the articles in political science are four authored.

Table 1

*Distribution of percentage of papers with different number of authors in various subjects*

Subject	Number of Authors Per Article								
	1	2	3	4	5	6	7	8	>8
Mathematics	63.70	30.36	4.61	0.93	0.27	0.04	0.09	-	-
Pure Math.	73.23	24.24	2.53	-	-	-	-	-	-
Applied Math.	62.14	30.37	5.50	1.39	0.40	0.07	0.13	-	-
Statistics	59.66	37.22	3.13	-	-	-	-	-	-
Physics	37.76	32.34	14.21	7.0	5.06	1.47	1.03	0.50	0.62
Solid State Physics	42.92	36.81	11.55	4.30	1.70	0.91	1.25	0.23	0.33
Optics	32.04	31.38	17.57	10.61	5.08	1.77	0.77	0.33	0.44
Nuclear Phys.	27.48	30.17	18.70	7.85	9.09	2.48	1.76	1.14	1.35
Electronics	54.21	30.84	6.39	4.36	3.58	0.31	-	0.16	0.16
Mechanical Engg.	63.40	27.00	8.40	0.40	0.80	-	-	-	-
Philosophy	87.70	9.57	2.42	0.26	0.05	-	-	-	-
Psychology	69.18	22.09	7.71	0.86	0.17	-	-	-	-
Philosophy excld. Psych.	95.90	4.02	0.08	-	-	-	-	-	-
Political Sc.	96.15	2.96	0.73	0.10	0.06	-	-	-	-
Govt. & Politics	96.05	3.50	0.15	0.30	-	-	-	-	-
Political Sociology	90.94	6.65	2.11	0.30	-	-	-	-	-
Sociology	94.33	3.78	1.89	-	-	-	-	-	-
Socialism (Theory & Pr.)	97.96	1.65	0.25	-	0.13	-	-	-	-

### **Three Authors**

14.21% of the articles in physics, 8.4% in mechanical engineering, 4.61% in mathematics, 2.42% in philosophy, and 0.73% of the articles in political science are three authored.

### **Two Authors**

32.34% of the articles in physics, 30.36% in mathematics, 27.0% in mechanical engineering, 9.57% in philosophy and 2.96% of the articles in political science are double authored.

### **Single Author**

96.15% of the articles in political science and 87.7% of the articles in philosophy are single-authored. 63.7% of the articles in Mathematics and 63.4% of the articles in Mechanical Engineering are single authored. In physics only 37.76% are single authored.

### **Multiple Authorship**

The percentage of multiauthored articles in different broad subjects are given in Table 2.

Table 2

*Percentage of single-authored and multiauthored papers, average number of authors per article and degree of authorship collaboration in various subjects*

Subject	% of Single Authored	% of Multiple Authored Article	Average No. of Authors per Article	Degree of Collaboration Article
Mathematics	63.70	36.3	1.44	0.363
Pure Math.	73.23	26.77	1.293	0.267
Applied Math.	62.14	36.86	1.483	0.368
Statistics	59.66	40.34	1.435	0.403
Physics	37.76	62.24	2.25	0.62
Solid State Physics	42.92	57.08	1.96	0.57
Optics	32.04	67.96	2.38	0.68
Nuclear Phys.	27.48	72.52	2.71	0.73
Electronics	54.21	45.79	1.75	0.46
Mechanical Engg.	63.40	36.60	1.482	0.37
Philosophy	87.01	12.30	1.15	0.12
Psychology	69.18	30.82	1.40	0.31
Philosophy excld. Psych	95.90	4.10	1.04	0.04
Political Sc.	96.15	3.85	1.05	0.04
Govt. & Politics	96.05	3.95	1.05	0.04
Political Sociology	90.94	9.06	1.12	0.09
Sociology	94.33	5.67	1.08	0.06
Socialism (Theory & Pr.)	97.96	2.04	1.03	0.02

It is seen here that in nuclear physics and optics there is high rate of collaboration within the researchers. The collaboration is very low in political science and philosophy excluding psychology.

#### **Average Number of Authors Per Article**

The average number of authors per article in different broad and subjects specific are given in Table 3.

The average number of authors per article is over two only in case of nuclear physics and optics.

#### **Degree of Authorship Collaboration**

The degree of authorship collaboration in articles of different broad and specific subjects are given in Table 4.

The degree of collaboration is highest in physics and lowest in political science.

Table 3

*Year wise distribution of percentage of multiple authorship trends of references in different subjects*

Subject	Upto 1950 % of multi auth. Ref.	1951-60 % of multi auth. Ref.	1961-70 % of multi auth. Ref.	1971-80 % of multi auth. Ref.	1981-90 % of multi auth. Ref.
Mathematics	10.82	24.13	34.47	47.82	64.97
Pure Math.	8.45	15.10	20.56	34.59	75.00
Applied Math.	14.66	24.90	37.27	50.73	62.50
Statistics	0.0	28.36	34.23	52.46	63.64
Physics	31.76	43.59	56.01	68.99	79.30
Solid State Physics	31.25	47.52	57.26	73.74	87.60
Optics	30.00	33.33	63.24	71.03	75.00
Nuclear Phys.	56.00	60.00	60.00	73.75	84.25
Electronics	20.93	25.71	41.75	51.15	63.56
Mechanical Engg.	26.53	46.87	33.73	34.19	40.28
Philosophy	2.48	8.17	12.99	18.33	28.93
Psychology	10.71	28.07	28.37	31.35	42.42
Philosophy excl'd. Psych.	1.92	3.61	3.46	8.54	6.67
Political Sc.	1.22	2.64	6.13	5.73	4.91
Govt. & Politics	0.0	5.65	3.70	5.42	5.36
Political Sociology	22.90	8.33	6.48	11.11	10.00
Sociology	1.80	5.88	18.37	7.33	6.00
Socialism (Theory & Pr.)	0.0	1.17	5.22	3.32	1.27

**Decade Wise Distribution of Multiple Authorship**

Decade wise distribution of percentage of multiple authorship trends of references in different subjects are given in Table 3 and decade wise trends of degree of authorship collaboration in different subjects are given in Table 4.

In all the branches of physics and mathematics and in psychology the multiple authorship trends have increased steadily through decades. (Table 4).

In mechanical engineering, philosophy excluding psychology and all the branches of political science, the multiple authorship trends have increased in the first few decades but then the trends have decreased for certain period.

Thus, in mechanical engineering the multiple authorship was highest during 1951-1960. In philosophy excluding psychology it was highest during 1971-1980 and in political science the multiple authorship was highest during 1961-1970. These indirectly show the trends of development in the subjects. The trends are shown in figure 1 and 2.

Table 4

*Year wise distribution of degree of authorship collaboration of references in different subjects*

Subject	Upto 1950 (Degree of Collab.)	1951-60 (Degree of Collab.)	1961-70 (Degree of Collab.)	1971-80 (Degree of Collab.)	1981-90 (Degree of Collab.)
Mathematics	0.11	0.24	0.34	0.48	0.65
Pure Math.	0.08	0.15	0.21	0.35	0.75
Applied Math.	0.15	0.25	0.37	0.51	0.62
Statistics	0.00	0.28	0.34	0.52	0.64
Physics	0.32	0.44	0.56	0.69	0.79
Solid State	0.31	0.48	0.57	0.74	0.88
Physics					
Optics	0.30	0.33	0.63	0.71	0.75
Nuclear Phys.	0.56	0.60	0.59	0.74	0.84
Electronics	0.21	0.26	0.42	0.51	0.64
Mechanical Engg.	0.27	0.47	0.34	0.34	0.40
Philosophy	0.02	0.08	0.13	0.18	0.29
Psychology	0.11	0.28	0.28	0.31	0.42
Philosophy excl'd. Psych.	0.02	0.04	0.04	0.09	0.07
Political Sc.	0.01	0.03	0.06	0.06	0.05
Govt. & Politics	0.0	0.06	0.04	0.05	0.05
Political	0.13	0.08	0.06	0.11	0.10
Sociology					
Sociology	0.02	0.06	0.18	0.07	0.06
Socialism (Theory & Pr.)	0.0	0.01	0.05	0.03	0.01

**INCREASING TREND OF MULTIPLE AUTHORSHIP**

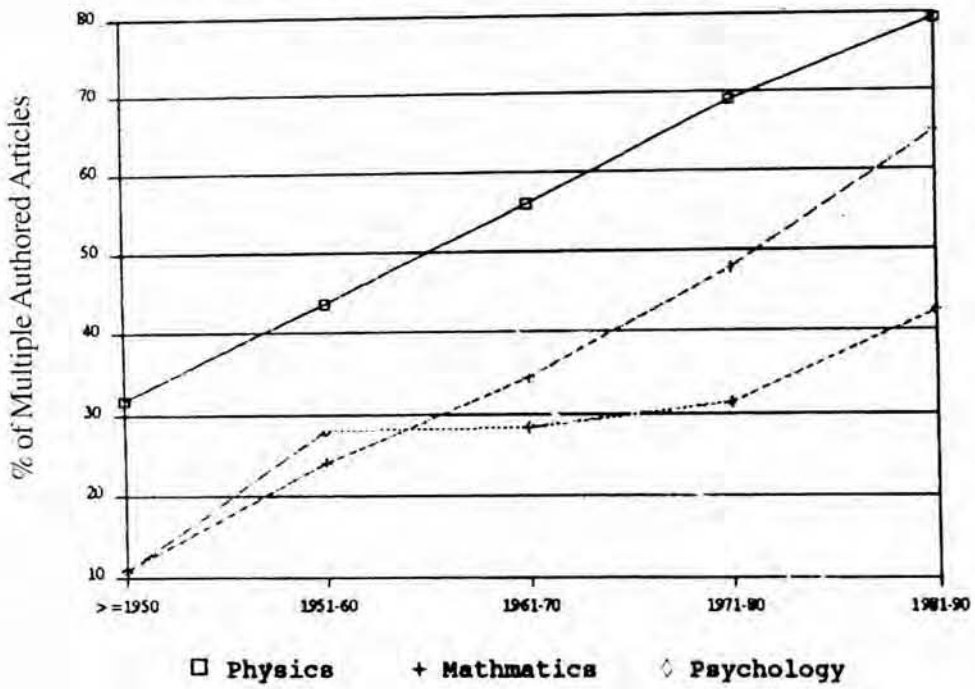


Fig. 1

**CHANGING TREND OF MULTIPLE AUTHORSHIP**

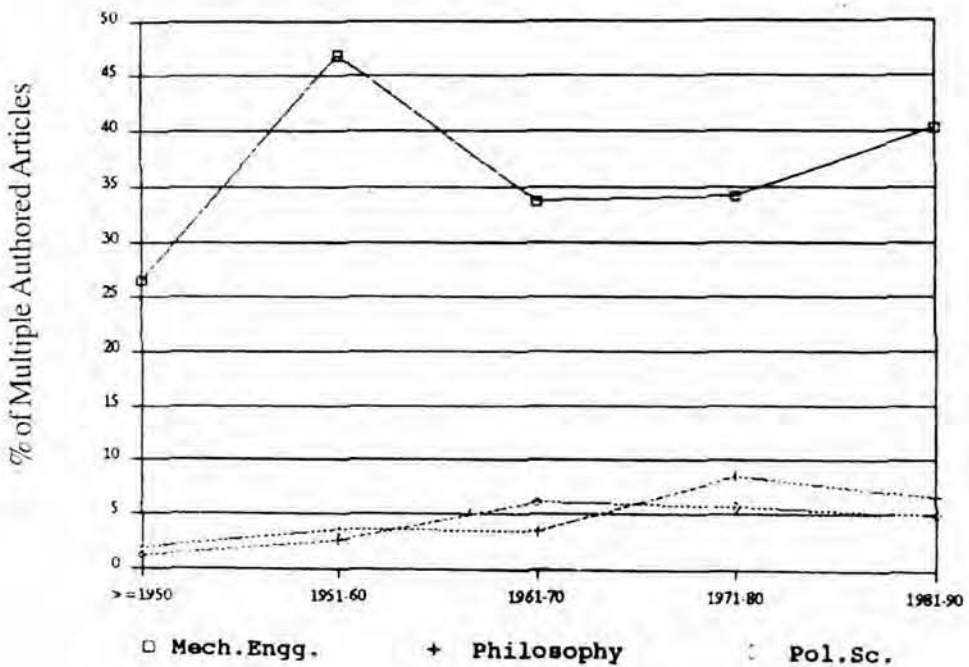


Fig. 2

## FINDINGS

Following are the findings from the various analysis:

- Within broad subjects, multiple authored articles are found maximum in physics (62.24%). 36.6% of the articles in mechanical engineering, 36.3% of the articles in mathematics, 12.3% of the articles in philosophy and only 3.85% of the articles in political science are multiple authored.
- Within specific subjects, multiple authorship is highest in nuclear physics (72.52%). It is more than 45% in every branch of physics. It is 40.3% in statistics and nearly 37% in both applied mathematics and mechanical engineering. In psychology, the multiple authorship is 30.8%. Whereas in philosophy excluding psychology it is only 4.1%. The multiple authorship in different subdivisions of political science varies from 9% to 2% only.
- The average number of authors per article in different broad subjects are -Physics 2.25, Mechanical Engineering 1.482, Mathematics 1.44, Philosophy 1.15, and Political Science 1.05.
- Within specific subjects, the average number of authors per article is highest in nuclear physics (2.71). It is 2.38 in optics, 1.96 in solid state physics and 1.75 in electronics. The average number of authors per article is more than 1.4 in mechanical engineering, applied mathematics and statistics. It is 1.4 in psychology but only 1.04 in philosophy excluding psychology. It is 1.29 in pure mathematics, 1.12 in political sociology and less than 1.1 in other branches of political science.
- Multiple authorship trend has increased steadily through decades (1950 to 1990) in all the branches of physics and mathematics. Steady increase in multiple authorship is also found in psychology. In mechanical engineering, philosophy excluding psychology and in all the branches of political

science the multiple authorship trend has increased in the first few decades but then the trend has decreased for certain period. In mechanical engineering the multiple authorship was highest during 1951-1960. In philosophy excluding psychology, it was highest during 1971-1980 and in political science the multiple authorship was highest during 1961-1970. This indirectly shows the trend of development in the subjects.

## CONCLUSION

From the discussions above it can be concluded that:

- Authorship collaboration is high in physics. Moderate collaboration exists in mathematics and mechanical engineering. The collaboration is very low in political science and philosophy excluding psychology. It is highest in nuclear physics followed by optics.
- Although the multiple authorship trend has increased steadily through decades (1950 to 1990) in all the branches of physics and mathematics and also in psychology; in mechanical engineering, philosophy excluding psychology and in all the branches of political science the multiple authorship trend has declined for certain periods.
- Inter-disciplinary and inter-institutional studies should be encouraged for more and more development of the subjects.

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