CHAPTER 5

SUMMARY, FINDINGS & CONCLUSIONS
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The purpose of this chapter is to present a summary of the findings of the study and the conclusions arrived at from the findings.

This has been a descriptive and analytical study in that it attempted to describe or quantify a phenomenon, that is, periodical literature on educational technology published from January 1998 to December 2007 and as covered in the online database SCOPUS.

The investigation was carried out on the population in its natural state which are unobtrusive or non reactive. Hence there is no possibility of any personal prejudice or preconceived notion on the part of the investigator.

The methodology used was to apply bibliometric techniques to the educational technology literature published in the journals during 1998 – 2007 and covered by the online database SCOPUS. All the source articles, the references appended at the end of all the articles and the citations received by each article in the journals belonging to the core or nucleus were analyzed using general bibliometric techniques. Bradford’s law of distribution, Price’s observations, Lotka’s law were also tested.
The general purpose of the study was to analyze bibliometrically the most recent journal articles on educational technology literature published during the ten year period 1998 – 2007 in order to identify and quantify the characteristics of literature in a body of knowledge.

The specific purpose of the study was to identify the periodicals covered by SCOPUS that contained articles on educational technology which would prove to be useful to the practitioners in the field of education. Educational Technology has several dimensions as it is a new discipline. The introduction of Educational Technology in the field of Education enables education to be more productive, more individualistic. It gives instruction a more scientific base and makes it more powerful. It makes learning more immediate and access easier. The convergence of technologies – the computer technology, the communication technology and information technology – is bringing about a radical transformation of our society into a knowledge society. This involved analyzing the periodicals containing articles on educational technology in order to identify the communication and citation patterns of the periodicals and the authors of the articles.
5.1 FINDINGS

The results of the study show that during the ten year period covered by the study, 1660 records which dealt with educational technology were published in 436 journals covered by SCOPUS.

The category wise analysis shows that 55.42% of the total output was in the category of journal articles; 18.49% as reviews 12.95% Conference proceedings, editorial 4.45%; note 3.19%; short survey 3.13%; and letters 2.33%. In general, publications of articles in journals take the predominant position. It is due to the prevalence of greater level of percolation and dissemination effects of journal articles. The journal articles serve as a convenient platform for effective exchange of ideas among the scholars.

Language wise analysis reveals the dominating influence of English language on the researchers in various disciplines. The contributions in 18 more languages are very small totaling 7.28% of the total contributions.

The country wise performance of educational technology researchers show that though authors from 57 countries have contributed articles major contributions are from the developed countries such as U.S.A, U.K, Canada, Australia, Netherlands etc. The contributions from authors affiliated to the under developed and developing countries are very low. It is surprising to note that in spite of significant development in the field of Education, Science and Technology India's contribution is just 1 out of 920 articles. The
international collaboration between authors of different countries is also low as only ten articles show collaboration between authors of different countries.

The year wise publication of articles on educational technology shows fluctuations from year to year. The most productive year in terms of number of articles published is 2005 and the years 2003, 2004 and 2005 account for almost 45% of all the articles published during the study period. The year 1998, the first year included in the study is the least productive. The year wise rate of growth is also not consistent. This may be interpreted as though there is continuous interest in the educational technology concept the publication of articles shows an inconsistent trend.

It is of interest to note that no periodical has published articles on educational technology in each year of the ten year period.

Application of Bradford's law and dividing the 920 articles into three zones of approximately equal number of articles shows the number of periodicals in each zone as 24: 119: 293 which does not conform to Bradford's formula $1:n:n^2$.

The Bradford multiplier to find out the maximum number of zones into which the periodicals can be divided shows a value of 3.71 leading to the division of 436 periodicals into four zones.
The core, or nucleus of the Bradford's zones contains 11 journals. However, the data on educational literature is not a fit in the Bradford's law with regard to the number of journals in each zone in the ratio of $1:n:n^2$.

Application of Goffmann's formula gives the transition point between low productivity and high productivity as 23 which means that even out of eleven journals in the nucleus only two are highly productive and another two nearing high productivity.

The bibliograph of educational technology literature plotted using the cumulative sum of journals as abscissa and the cumulative sum of articles as ordinate does not match the bibliograph's obtained by Bradford in the case of Geophysics and Lubrication literature. Most probably, the concentration of journals contributing only one article may be the reason.

The study of the growth rate of educational technology literature shows the relative growth rate decreasing gradually from 0.81 in 1999 to 0.11 in 2007. The overall relative growth rate is 0.33. While the relative growth rate shows a decreasing trend, the mean doubling time for the publications in educational technology is computed as 3.62. The conclusion is that while the relative growth rate shows a decline in trend the doubling time for the publications has shown an increasing trend.

A similar trend is observed with regard to the relative growth rate and doubling time for the educational technology literature in terms of the
number of pages. The overall mean for the relative growth rate is 0.33 and 3.26 years for the doubling time in terms of no of pages is 3.26 respectively.

The analysis of the articles for authorship trend shows that only 27.17% of the articles are single authored while 72.83% are multi-authored. The point of interest here is that there are two authored to 20 authored articles. Further, there are single authored to seven authored contributions every year of the 10 year study period. Collaborative articles authored by more than 10 authors work out to 20! 14, 17, 18, 19, and 20 authored collaborative publications point to the prevalence of multi-authored trend among the authors contributing articles on Educational Technology. The conclusion from the above facts is that Educational Technology, as a discipline is slanted more towards Science and Technology where multiple authorship rules supreme. Price has observed that solo research will be facing extinction in the near future.

The Degree of Collaboration calculated by using Subramanyam’s formula corroborates the above conclusion. The value of the Degree of Collaboration works out to 0.73.

Many studies have established that the acceptance rate of articles, with collaborative authors, for publication in leading journals tends to be higher than for single authored works. It has also been found that there is a high degree of correlation between collaboration and research productivity,
and collaboration and availability of financial support for research. In short collaboration is taken to mean better quality and standard of a paper.

The findings on Author Productivity shows that the number of authors contributing only one article during the period of ten years outnumber the authors who have contributed more than one article. The maximum number of articles contributed is only five and that too only by one. The number of authors who have contributed 4, 3, 2 articles are 2, 15, and 89 respectively. Even a cursory glance of the data shows that author productivity of Educational Technology literature does not conform to Lotka's Law. The reason for such wide disparity may be attributed to too many authors with single contribution only i.e. 95.98 % of authors with single contribution; 3.34 % with 2 articles; 0.56% with 3 articles; 0.08% 5 articles. The % of authors with single contribution is far above the 60 % suggested by Lotka. Further, the proportion of number of article per author per paper is very low and the number of authors per paper is high.

The findings of the year wise distribution of citations reveal that the year 2005 has recorded the maximum of 18.9% of the total number 16251 cited references. The year 2007 ranks second with 17% contribution and the years 2001, 2003 and 2004 occupy the third, 5th and 4th ranks respectively. From 1013 references by 53 journal articles in 1998 the number has increased to 16251 references by 920 articles in 2007. The mean reference per article works out to 17.66 which is more than 15 as observed by price.
With regard to the number of cited references per article the year 2007 is the first order with 30.12 references per article followed by 2001 with 19.57. Hence Price's observation regarding the normal number of references per article is validated.

The source wise analyses of the cited references bring forth the following facts. Of the 16251 cited references, journals occupy the first priority of the authors as the major source of information. Journals account for 55.73% of the cited references; Books constitute the next major source of information with 35.44% of cited references from books. From 396 references in 1998, the number has risen to 5760 in 2007. The years 2007 and 2005 have recorded 1141 and 1101 references from books. This is a marked increase in the number over the other years. The value of the coefficient of the variation 49.8 is because of the steep increase in 2005 and 2007.

Conference proceedings occupy the third position but there are only 782 references from conference proceedings in the 10 year study period. This shows that conference proceedings contribute only 4.81% of the total cited references. Of the 782 references 263 are in 2005 and 157 in 2007 the number of cited references in other years is very small.

Reports in bulletins are in the fourth order to the just 3.42% of the total number of references. The number of cited references from dissertations and case studies, miscellaneous and undefined items are
negligible. The above analysis points to the fact that the authors of journal articles in educational technology follow the trend of Big Sciences in the use of journals as their major source of information. It is evident from the above analysis that educational technology literature displays a slant towards science and technology.

Analysis of the age of cited references show that the age ranges from 0 to 207 years. The median citation age of the education technology literature is calculated as 4 years and 10 months. The half life of educational technology literature calculated by plotting the age of citation in the x axis and the cumulative number of citations in the y axis corroborates the median citation age calculated by using Price’s formula. A comparison of the median citation age and half life with other subjects shows that educational technology literature equals the half life of applied sciences which is found to be 4 to 5 years. The values given by Burtan and Kepler for various subjects again shows that educational technology literature is slanted towards science and technology so far as the practice of the authors of articles in the use of the sources of information.

Results of the analysis of the Age of citations reveal that the age of cited references ranges from 0 to 207 years the publication dates of the cited references ranging from 2007 to 1800. The Median citation age is calculated as 4 years and 10 months i.e. the time for decay or obsolescence.
of 50% of the documents cited as references in Educational technology literature.

The half-life of Educational Technology literature is found out graphically by plotting the age of citation on X axis and cumulative number of citations on the Y axis. The result from the graph also confirms the result as 4 to 5 years.

The analysis of the Age and the half-life of the cited references of Educational Technology literature and the comparison of the values with those of other disciplines arrived at by earlier studies show that the Educational Technology literature is slanted towards Science and Technology.

Considering the citations received by the articles published in the 11 journals that comprise the core or nucleus zone, show interesting results. When the 11 journals are arranged in the descending order of the number of articles published, the following order is seen: Educational Technology and Society (53); Computers and Education (40); IEEE Transactions on Education (20); Educational Technology Research and Development (19); Studies in Health Technology and Informatics (16); British Journal of Educational Technology (14); Medical Teacher (12); Academic Medicine (11); Journal of Dental Education (11); Journal of Educational Computing Research (11); American Journal of Physiology-Advances in Physiology Education (10).
The highest number of citations received is 164 by the journal ‘computers and education’ which has published 40 articles in 10 years and the lowest number of 17 citations is recorded by the Journal of American Physiology: Advances in Physiology Education. Educational Computing and Research has published 11 articles and has received only 18 citations in all. If the number of citations per article is considered, the journal Academic Medicine stands first with 97 citations received for 11 articles working out to 8.8 citations per article. The other journals which have recorded significant number of citations per article are: Computers and Education 4.1; IEEE Transactions on Education 3.9; Educational Technology Research and Development 4.2; British Journal of Educational Technology 3.3; Medical Teacher 2.8 Journal of Dental Education 2.7

The h index for the set of documents published in the above journals is a pointer to the value of the journals in the discipline. The highest h value is 6 calculated for the set of 40 articles published in the journal Computers and Education; for a set of 11 articles published in Academic Medicine is also 6. The next position is 5 for a set of 20 documents published in IEEE Transactions and for a set of 14 documents published in British Journal of Educational Technology.
5.2 SUGGESTIONS

Based on the results of the above study, the following suggestions are made:

Since this study is limited to a period of ten years only, a more comprehensive study of Educational Technology literature could be undertaken covering the entire period from the recognition of the concept. It would be of interest to know whether the core or nucleus of journals remain the same, or show any minor or major changes. In the same way other results could also be observed.

Since this study has restricted itself to only one database- SCOPUS- more number of databases could be used and a comparative study could be undertaken.

The analysis of the citations received by the articles has been limited only to the 11 journals forming the core. Such a study may be extended to all the articles published in all the journals under study.

The quantity of Indian contribution to Educational Technology literature, as revealed by this study, is meagre. Efforts could be made to encourage research and publication of research articles by Indian researchers. The results of this study reveal that the field of educational Technology is slanted towards science and technology in the pattern of communication followed by the contributors of Educational Technology literature and that the field is having contributions from multi disciplinary and
inter disciplinary fields may be brought to the knowledge of researchers in the field.

The results of the study show an overwhelming number of authors with single contribution to their credit. There is a need to encourage productivity of authors.

The researchers in Educational Technology could work in a synergistic spirit with active interaction through research articles so that Educational Technology becomes a powerful tool in the field of Education.

Bibliometric techniques could be applied to find out the productivity of researchers, institutions and journals. This study has applied the concept of h index developed in 2005 by Hirsch, a condensed matter physicist. Since then a number of bibliometric indicators have been proposed and developed. Studies using such new indicators may be taken up. For example, comparative studies applying g-index, developed by Leo Egghe in 2006; contemporary h-index proposed by Sidiropoulos et. al, in 2006; individual h-index (2 variations) by Batista et. al, and Age-weighted citation rate in 2007 inspired by Bihui Jin etc. may be undertaken. The results of such comparative studies will be of immense benefit to researchers in all disciplines.
Studies highlighting the bibliographic services offered by reputed online database providers, such as, Web of Science, Web of Knowledge, and Citation indexes, SCOPUS etc may be of great service to researchers in all fields.

5.3 CONCLUSION

Bibliometric studies reveal the general communication pattern among the scholars in a particular field. The impact of the journals and the articles published by them on scholars in the field are revealed by the h-index and other bibliometric indicators. The quantitative and statistical studies throw light on how many articles are published, who is contributing more, whose articles are receiving more number of citations and overall show the growth rate of the literature. The results of such studies are used by the administrators to decide Promotion policies and sanctioning of financial grants. Thus, bibliometric studies create an awareness on researchers to publish more number of articles in journals of impact and importance to gain more recognition and respect. Further, they provide useful information for collection management in libraries and information centres in the context of soaring prices and shrinking budgets.