Information Seeking in the Present Digital Age by Biomedical Scientists in India

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Abstract: *The present paper deals with some common aspects of information seeking behaviour (ISB) of biomedical scientists especially average age of documents used, frequency of its use, impact of Internet on information publishing and effect of hyperlinks on reading etc. An online survey was organised using SurveyMonkey online software. 1013 scientists were considered for study in which questionnaires sent by 313 were considered for data analysis confirming confidence level 95% and confidence interval within ±5%. It aws found that hyperlinks are supportive in general reading and generally documents are read within a week of publication.*

Key Words: Information Seeking Behaviour, Hypertext, Hyperlink, Text, Audio-visual Resources, Electronic Resources, Print Resources.

1. Introduction: Texts on print media was used for information preservation and communication from a long time along with graphs, tables, diagrams and images which is being used in electronic format today. Reading on screen (in electronic format) needs extra information literacy (**Thurston**, 2000), but its soft presence gives chance to edit it repeatedly. Using text on papers/screen is more than only speaking and hearing a text as it needs scripts to write it. Animations and audio-visual resources in electronic format are unique for prints which can include use of texts, graphs, tables, diagrams and images. **Goodman** (1967) states reading a psycholinguistic guessing game which involves an interaction between thought and language. The process of comprehension involves the reader in a complex, dynamic, ongoing interaction with the text. A reader searches his memory for syntactic, semantic and phonological cues related to the text and makes changes in his previously imagined perceptual image by selecting some appropriate graphic image.

Introduction of electronic media changed the process of information publishing; and time lag between information creation and its publishing, decreased drastically. Electronic media

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elaborated the concept of multimedia at the same time it gave space to originate the concept of hypermedia also by help of hyper linking. World Wide Web originated such a way is an immense source of information and **Bolter** (1998) considered it as a vast hypertext. These new developments changed the process of information retrieval process and role of information intermediaries also changed in same accord. As information seeking behaviour (ISB) of people were being rippled by the Internet and World Wide Web. The knowledge about users needs is essential to serve them better by information professionals including librarians and information scientists. Hence voluminous studies are taking place to know the users, its needs and their attitude to serve them better and efficiently. The present study also tries to know some aspects of the same in reference to biomedical research libraries and its principal users i.e. scientists.

1.1. Objectives: The objectives of the present study are as followed.

a. To know the status of textual and audio-visual forms of information being used by biomedical scientists.
b. To know the effect of hyperlinks on general and serious reading.
c. To know the effect of Internet on information publishing and age and use frequency of documents by biomedical scientists.

1.2. Scope and Limitations: The study covers all over India geographically, but limited to four apex bodies under central government i.e. Indian Council of Medical Research (ICMR), Council of Scientific & Industrial Research (CSIR), Department of Biotechnology (DBT), Department of Science & Technology (DST) and some autonomous institutes. The scientists were selected comprehensively from medical and life sciences.

2. Review of Literature: **Tenopir & King** (1998) had observed during initial years of Internet that much of the reading by scientists of University of Tennessee took place within six months of publication. But the Internet changed the scenario and people could access more recently published information. **Jamali and Nicholas** (2008) found ten years later of it, that one third (32.7%) of 98 faculty members and research scholars in astronomy and physics in University College, London read articles published one week before.

The Internet catalysed the process of information publishing as well as getting information sources through it. **Budd** (1999) found that faculty were, on average, publishing more in 1995-97 than in the 1991-93 in selected ARL (Association of Research Libraries) and ACRL

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(Association of College and Research Libraries) institutions. It increased communication also between faculty (**Budd**, 1999) and researchers.

Leu & Reinking (1996) point out that electronic hypermedia is interactive at the place of static text on papers, and reader and text become interdependent. According to **Botler** (1998), the main characteristics of hypertext are fluid text of unstable and unpredictable nature (influenced by the decisions of the readers). Literacy is transformed to use the hypertext as hypertexts are unique characteristics of electronic format as compared to print (**Reinking**, 1998). Manipulatibility and reconfigurability is permitted with greater ease in the case of digital formats and also needs upgraded literacy (**Landow**, 1996). Difference exists in the way – not only we read, but the way we concentrate on texts on electronic and print (**Levy**, 1997). The hyperlinks proves sometimes problem as it drive us away from the mainline in narrative text (**Gilster,** 1997), however suits to research works (**Gilster**, 1999).

3. Research Methodology: To accomplish the objectives of the study, an online survey was organised applying online software SurveyMonkey. The survey was proposed at 95% confidence level and ±5% confidence interval. Scientists from 51 institutes from different organisations under Ministry of Health & Family Welfare and Ministry of Science & Technology were selectively taken. A questionnaire was structured to know about ISB in digital era. Total 1013 scientists were considered for the study in which email IDs were available of 974 scientists only. However due to various issues, questionnaire could be delivered to 702 scientists only. More than 325 questionnaires were received for the study in which some had much incomplete and could not be considered for the study. Hence number of questionnaires for the study was only 313. Where evaluated size of sample is only 279 using the following formula (Morgan formulae):

Sample Size for Finite Population = $\frac{SS\omega}{1+\frac{SS\omega-1}{Pop}}$

Where,

SSω = Sample Size for Infinite Population = $\frac{Z^2 \times (p) \times (1-p)}{C^2}$

Z = Z - value (1.96 for a 95 percent confidence level)

p = Percentage of population picking a choice expressed as decimal

c = Confidence Interval expressed as decimal

Pop = Population

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4. Data Analysis: Data collected were arranged, counted and calculated to draw fruitful results which are discussed in later paragraphs.

4.1. Demographic Structure of the Respondents: Number of respondents in lowest and highest age groups (21-30 Years and '61 and above' respectively) is minimal. 4.8% of respondents only lie in these two age groups. Largest number (35.1%) of respondents is in the age group 31-40 Years followed by age groups 41-50 Years (31.9%) and 51-60 Years (27.5%) respectively. More than two thirds (70.3%) of respondents are males and the rest are females. Almost half (49.2%) of respondents are at middle level (Scientist – D/E/F) of designations followed by Scientist –B/C (32.3%) and Scientist – G/H (18.5%) (Table 4.1).

Table 4.1: Demographic Structure of the Respondents

Age (in Years)	**Number**	**Gender**	**Number**	**Designation Levels**	**Number**
21-30	4 (1.3%)	Female	93 (29.7%)	Scientist – B/C	101 (32.3%)
31-40	110 (35.1%)	Male	220 (70.3%)	Scientist – D/E/F	154 (49.2%)
41-50	100 (31.9%)	**Total**	**313**	Scientist – G/H	58 (18.5%)
51-60	86 (27.5%)			**Total**	**313**
≥61	11 (3.5%)				
Not specified	2 (0.6%)				
Total	**313**				

4.2. Rankings of Types of Information: In a question, respondents were asked to rank types of information from first rank to fifth rank from the options of 'text', 'graphs, tables and diagrams', 'images (photographs)', 'animations' and 'audio-visual resources'. The first three types (text, graphs, tables, diagrams and images) are writable on print and electronic – both. But, the two last types (animation and audio-visual information) are possible in electronic format only.

Audio are based on languages and audio-visual information are based on operations and languages, hence knowledge of speaking and hearing of a language is needed to study such

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resources. These types of resources are very new as recording of such type of information has been possible some decades before. Animations are similar to audio-visual resources as these are computer generated at the place of real recording of audio-visual resources. Texts are primitive than these resources, however need knowledge of scripts also in which a particular language is written. In this way, text requires knowledge of coding and decoding of signals (in form of scripts). Speed of reading a text can be controlled more easily than audio-visual resources.

'Graphs, tables and diagrams' and images elaborate texts whenever required, sometimes playing vital roles in understanding. It is different from texts as these are drawn using some straight and curved lines.

The respondents replied to this question differently. However texts were ranked first overall by the respondents. The other types were ranked in the following order:

Type of Information	Rank Scores*	Overall Ranks
Text	1.59	1
Graphs, Tables & Diagrams	2.22	2
Images (Photographs)	2.73	3
Animations	4.04	4
Audio-visual Resources	4.42	5

*1st rank = 1; 2nd rank = 2; 3rd rank = 3; 4th rank = 4; 5th rank = 5

It is obvious that larger scores mean lower ranks and vice-versa.

4.3. Proportion of Audio-Video Resources among All Used Resources: In the next question, respondents were asked to disclose the percentage of audio-visual resources used by them out of all the used resources by them so that its amount can be estimated for biomedical scientists. More than half (53.3%) of respondents had use proportion of below than 5% out of all used resources in which 15.9% of them have use proportion as almost

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zero only. 28.7% of respondents had use proportion as 5-10% of total used resources including each formats. Only one fifth (18.0%) of respondents were having this proportion as above than ten percent of total used resources by them (Figure 4.3).

Table 4.3: Use Proportion of Audio-Video Resources

Options	Almost Zero	Below 5%	5-10%	above 10%	Total
Sum	46 (15.9%)	108 (37.4%)	83 (28.7%)	52 (18.0%)	289

4.4. Average Age of Documents Used: Present digital era has availed documents to the users very quickly. However it is not necessary that those can be utilized immediately. The documents published might have importance up to some years. In the present question, respondents were asked how much old documents were consulted by the biomedical scientists. The purpose of this question was to know the proportion of recently published work that may be within a week too. More than two thirds (70.1%) of respondents replied that they read the documents published within a week. The reply to this one only option clears that scientists are interested in newly generated information **that can be availed online only**. About one fifth (18.1%) of the respondents read documents those are published within a month. Remaining 11.8% of respondents read documents older than a month in which again percentage of respondents reading a document within a year is 6.3% (Figure 4.4).

Table 4.4: Average Age of Documents Used

Options	Sum	Cumulative Sum
One Week	202 (70.1%)	70.1%
One Month	52 (18.1%)	88.2%
One Year	18 (6.3%)	94.5%
2-5 Years	10 (3.5%)	98.0%
5-10 Years	3 (1.0%)	99.0%
>10 Years	3 (1.0%)	100%
Total	**288**	

Table 4.5: Average Use Frequency of Documents

Options	Sum	Cumulative Sum
Only One	116 (41.0%)	41.0%
Twice	73 (25.8%)	66.8%
Thrice	24 (8.5%)	75.3%
4-10 Times	12 (4.2%)	79.5%
Unlimited	7 (2.5%)	82.0%
Can't Say	51 (18.0%)	100%
Total	**283**	

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4.5. Average Use Frequency of Documents Used: The respondents were asked average number of repetitions of reading a document in a question. It was found that two thirds of respondents read the document a single time (41.0%) or two times (25.8%) at average. 8.5% of them read the documents thrice at average and 4.2% read 4-10 times at average. 2.5% use the documents unlimited times. 18.0% of respondents have opted 'can't say' option in reply. It clears that respondents tend to read the documents only one – two times generally (Figure 4.5).

4.6. Searching of Documents enlisted as References and Bibliographies: References and bibliographies elaborate and authenticate the materials described in the chapter/article. Documents enlisted in references and bibliographies reflect deep studies on those matters. In a question, respondents were asked, reading the documents such enlisted. More than three fourths (76.1%) of respondents often search such documents where 23.5% of them search sometimes such documents. Only 0.3% of respondents replied that they do not make search of such documents (Figure 4.6).

Table 4.6: Searching of Documents given as References and Bibliography

Options	Yes	Sometimes	No	Sum
Number	223 (76.1%)	69 (23.5%)	1 (0.3%)	293

This makes clear that biomedical scientists are interested in documents enlisted in references and bibliographies and hence interested in depth reading.

4.7. Opinion if Hyperlinks make Information Access Easy: In a question, respondents were asked how hyperlinks affect their information search process. There are studies supporting hyperlinks to be additive in information search process due to fluidity (**Liu & Reinking,** 1996; **Botler,** 1998) of it making reading enthusiastic and interactive. However some studies disclose that hyperlinks makes away from the main theme of information search. It was found after the survey that 93.1% of respondents have positive view on hyperlinks that it makes information search easier (Figure 4.7).

Table 4.7: Opinion if Hyperlinks make Information Access Easy

Options	Yes	No	Sum
Number	244 (93.1%)	18 (6.9%)	262

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4.8. Opinion if Hyperlinks supports Serious Reading: In next question, respondents were asked to opine if hyperlinks are supportive in serious reading. Almost two thirds (66.4%) of respondents agreed with the view that it supportive in serious reading while almost one-fourth (22.0%) agreed partially selecting the option 'Sometimes'. Only 11.6% of respondents did not agree at all with the view. It is important that some previous studies (**Gilster**, 1997) state that hyperlinks do not suit with flow of texts sometimes.

Table 4.8: Opinion if Hyperlinks support Serious Reading

Options	Yes	Sometimes	No	Sum
Number	172 (66.4%)	57 (22.0%)	30 (11.6%)	259

4.9. Opinion on ICT if it has supported to Information Publishing: The Internet has availed a voluminous amount of information online to the users. In the same fashion, people are publishing their documents on the Internet using various sources on World Wide Web or otherwise. In this question, scientists were asked about Internet how much it is supportive in information publishing in their opinions. There were total five options comprising three options of yes varying from 'up to 25%' to '51-100%', 'no' and 'can't say'. More than half (54.7%) of respondents selected the option 'Yes – 51-100%' followed by 'Yes – 26-50%' (21.6%) and 'Yes – up to 25%' (13.9%). Only 1.7% of respondents selected 'No' option which shows Internet being a dominant information publication platform (Figure 4.9).

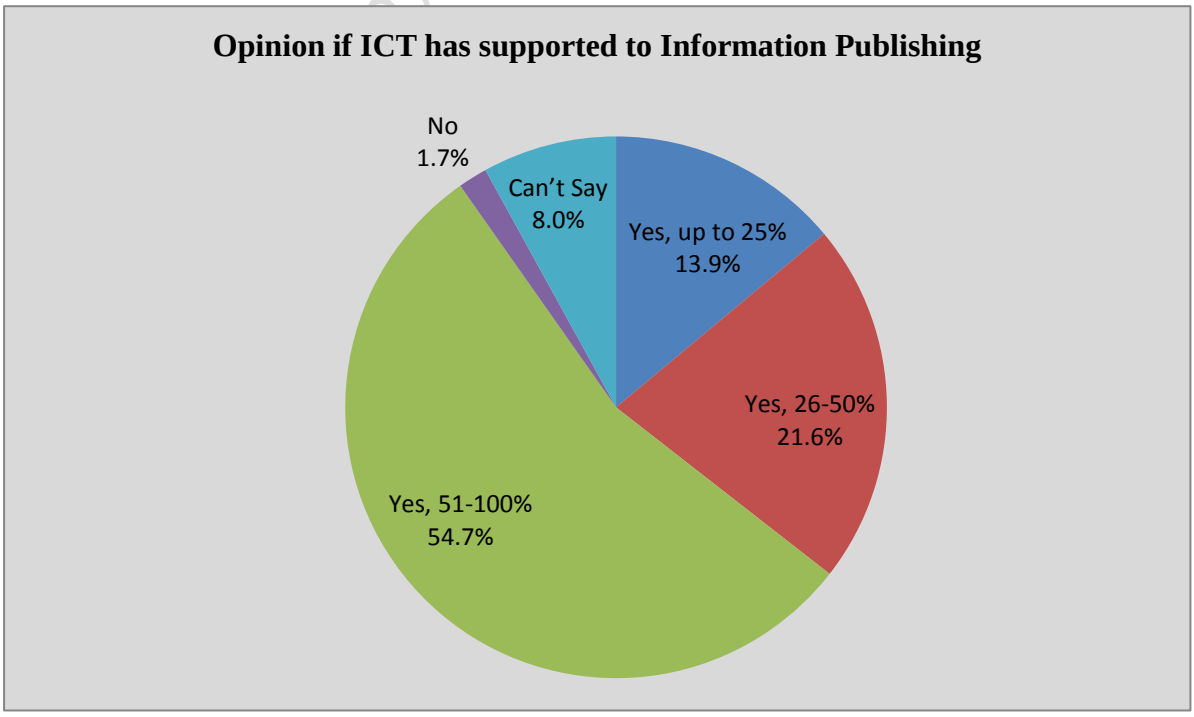

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Figure 4.9: Opinion if ICT has supported to Information Publishing

4.10. Comparative Analysis Based on Designation Levels of the Biomedical Scientists: To verify if there are differences in the attitude of scientists towards information seeking, comparisons were made based on different designation levels. Chi-square test was performed in each question. It was found that there are no prominent differences in information seeking between scientists at different strata.

Table 4.10: Comparative Analysis Based on Designation Levels

Sr.	Question	D. f.	χ^2 Value	Critical Value	Significance of Relationship
1	Use Proportion of Audio-Video Resources among All Used Resources	6	4.704	12.592	No
2	Average Age of Documents Used	10	5.083	18.307	No
3	Average Use Frequency of Documents	10	14.053	18.307	No
4	Searching of Documents given as References and Bibliography	4	5.340	9.488	No
5	Opinion if Hyperlinks make Information Access Easy	2	1.171	5.991	No
6	Opinion if Hyperlinks supports Serious Reading	4	8.833	9.488	No
7	Opinion on ICT if it has supported to Information Publishing	8	13.282	15.507	No

5. Discussions: After overall analysis, it is found that texts are important information type yet. However use of audio-visual resources has become significant as 18.0% of biomedical scientists are using them in a significant amount i.e. ten percent of all used resources types. Search for recent information is very fast in case of biomedical scientists as 70.1% of them access the information sources within one week which is far greater than the found percentage (32.7%) by **Jamali and Nicholas** (2008) for faculty and research scholars in University College, London in subjects of astronomy and physics. However it has not become clear either time lag or subject difference has any role in this regard. Hypertexts are

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found supportive in general and serious reading. However, it suits more to general reading. In a study **Gilster** (1997) had found hyperlinks not much supportive to narrative reading. Internet is found supportive in information publishing by large extent (54.7%) of respondents in ample amount (51-100% agree).

6. Suggestions: After the discussions above, it is clear that biomedical research libraries should proceed with textual from of information in it, however it is advised that it should maximise it's not only audio-visual collections, but it should also arrange for such rooms where these type of resources can be watched and studied. Experiences disclose that biomedical research libraries are neither having such rooms promptly, nor their collections of such resources are rich. Respondent's attitude towards utmost recently published documents clears that such libraries should have a clear-cut arrangement to arrange the required documents in a small span of time despite the cost applying inter-library loan, consortia or other means.

7. Conclusions: It is evident that biomedical scientists need very recently published documents in India and hypertexts and multimedia has affected them significantly. However importance of textual materials has remained integral yet. Overall texts are found strong information source being availed through online sources and development of digital era does not entitle disappearance of texts, moreover hyperlinked texts are found supportive in general and serious reading as a general.

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