

Subject searching in OPAC of a special library: problems and issues

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Abstract This paper drawing data from a comparative study of use of Online Public Access Catalogue (OPAC) and card catalogue of ISRO Satellite Centre (ISAC) library examines the steady decline in use of subject searching by end-users and the associated problems and issues; presents data to highlights negligible use of Boolean operators and combination searches, variations in descriptors assigned to books of the same class numbers, too many records tagged too broad descriptors, etc.; Concludes that moving from traditional card catalogue to modern OPAC has not made subject searching more attractive and effective.

Keywords OPAC; Subject Search

1. INTRODUCTION

'Subject approach' to knowledge has been a long and extensive concern of librarianship and is assumed to be the major approach (access method) of users for a very long period. In the card catalogue days, both classified part of the catalogue and subject catalogue (based on assigned standard descriptors) were assumed to help users to have subject access to the resources of a library. Access by classification number is believed to be more common in Europe and India than in US. Unfortunately very few studies have been conducted in those days to see the relative importance of this approach, success or failure of searches and user behavior towards subject access.

Card catalogues had plenty of cross references to help users even if they are not aware of standard descriptors and the same are lacking in OPACs. On the other hand, card catalogues primarily meant for pre-coordinated search where as OPACs enable post-coordinated searches using Boolean operators and other combination searches. Further, OPACs also enable executing vague and free text queries wherever KWIC indexes are provided, which is a great boon to users who are normally unaware of descriptors selected from thesaurus or subject heading list. Despite limitations users do prefer free-text searching. There are also efforts to create intelligent natural-language front ends which use subject headings / thesaurus for searching OPAC.

2. SOME PAST STUDIES

Studies on use of OPAC are plenty and there exists good number of reviews of OPAC studies (Larson, 1991; Heldreth, 1985; O'Brien, 1994). In a 30 months transaction analysis of patron search on OPAC of Ohio State University, Norden and Lawrence (1981) found that use of subject search commands increased rapidly (Quoted from Hildreth, 1991, p 262-3). Unfortunately OPACs are criticised as being more difficult to use and less

serviceable than card catalogues and used more for finding known items rather than to seek information or to solve information based problems (Borgman, 1996, p 494). However, there is a significant and consistent decline in controlled vocabulary based subject searching over years in favour of title keyword searching (Larson, 1991). The relative use of subject index in OPAC varied widely from 10 to 62% in different studies. In the famous CLR project, subject searching was found to constitute the majority (59%) (Mathews, et. al. 1983). But, Larson found a gradual decline in the use of the subject index as the size of the database increases. The frequency of title keyword searching exceeded that of subject searching over a period. But, as mentioned before, many title keyword searches are for known items.

'Subject access is the most problematic area of online catalogues' (O'brien, 1994). It often leads to either failure or retrieving too many references. Most of OPAC studies have identified the need to tackle the related issues like free text search, field directed search, training users, adjunct thesaurus help, limiting devices with 'filtering' effect, relevance feed back, ranking of retrieved references, etc., to reduce search failures, as most users cannot be expected to put serious/ extra efforts in subject searching. Even computer literacy does not ensure that users will do better subject searches.

OPAC is a 'black box' to users and they know very little about what happens inside the system. For example, trade off between precision and recall is rarely known to end-users. This may also be true of many library professionals who deal with OPAC routinely. OPACs are diverse in features as well as size. Functional layers mediating access of OPAC are user interface, DBMS interface, DBMS, and database (with indexes). Conceptually they can be grouped into (i) those that deal with the users and (ii) those that deal with the storage and retrieval of bibliographic data. Most enhancements to subject searching are through enhancements of the database and DBMS layers. The database layer can be seen as some portion of the contents of card catalog in machine-readable form. The other layers provide procedures to facilitate the process of delivering information to users (Larson, 1991, p 190-191).

Boolean logic appears to be one of the most difficult aspects of information retrieval and is not 'common sense' for most people (Borgman, 1986, p 390). Users tend to perform simple searches using only the basic features. Even scientists and engineers who have expertise in logic for other applications often use 'AND' and 'OR' in their linguistic sense (Borgman, 1986a, 1986b). The combination search or use of Boolean operator can greatly help users to reduce recall and increase precision so as to obtain a browsable size of hits. Users information needs range from highly specific to very general ones. Yet they make only simple searches. Most users search with single term that defeats the purpose of combination searches and Boolean logic.

"... Users rarely ventured beyond a minimal set of system features. The majority of searches were simple, specifying only one field or data type to be searched... [and] advanced search features.... were rarely used..." (Borgman, 1986, p 389-390). Most studies monitoring transactions have reported significant frequencies of input unidentifiable by the system, aborted sessions and searches with no matches. Not only "usage rates are low enough that many online catalog users probably remain permanent novices" (Borgman, 1986, p 390) but also users tend to perform simple searches using only the basic features and did not utilise index terms or headings unless 'forced' to do so (Borgman, 1986, p 389-390). Like use of other services of library and interactions with

library, use of OPAC is also skewed with a few using a lot and most using it little. Further, most end users search OPAC only occasionally and do not access the system on a regular basis and they tend to learn only enough to do simple searches reasonably quickly and to regard further instruction as unnecessary and more extensive expertise as a burden (Yuan, 1997, p 218). In OPAC use studies, no-match subject searches ranged from 35% to 57% (Borgman, 1986, p 389-390). Dickson (1984) found that 37% of all title searches and 23% of all author searches resulted in no matches. She determined that 39.5% of the no-match title searches and 51.3% of the no-match author searches were for records that existed in the database and not due to user error in searching (Quoted from Borgman, 1986).

Hirst (1999) through a questionnaire survey of users with different levels of IT expertise about use of hypertext interfaces to LIS found that OPAC searches were mainly conducted for specific items and that most were successful. It may be noted that most of specific item searches are other than subject searches. Interestingly novice users tended to achieve higher success rates than expert users.

" Identifying search terms for the subject catalog is hardest of all, since, people often do not recognise that the subject entries are drawn from a controlled list or thesaurus that is separately searchable itself. Instead, they enter the catalog using the free-text keywords they know best, often on a trial and error basis" (Borgman, 1996, p 497). One way to guide end-users is to enable them to choose a subject term from the classification number of the book. There is a great need to link subject headings to classification numbers.

Drabenstott and Weller (1994) summarised the problems of subject access based on the findings of the past studies : (1) one-third of subject queries fail to produce results (ii) large retrievals (high recall) discourage users from scanning the results (iii) few instances of successful matching of query with controlled vocabulary are one-word queries (iv) users are discouraged by subject access and are seeking alternative approaches. They feel that system designs enhancing subject headings, developing menu-based interfaces and extending online catalog functionality to other databases meet the demands of library staff and not necessarily that of users for search functionality. Hence the problems found in the earliest OPACs still continues to exist as far as users are concerned. They have proposed 'search trees' for subject searching after running an experimental online catalog called ASTUTE.

Search failures are usually due to misspelling, lack of knowledge of thesaurus, 'false drops', lack of user understanding of Boolean operators, lack of cross references, lack of online thesaurus and lack of training. There was a significant positive correlation between the failure rate and the percentage of subject searching (Larson, 1991) and a negative correlation between failure rate and time. Longer the processing time/ rate more the chances of user abandoning the search. Subject searches often lead to unusually high recall and create the problem of information overload. The average number of records retrieved are very high (about 77) and users look only few (about 9) (Larsen, 1991). Often, users prefer browsing shelf rather than browsing through subject access. Larson (1991, p20) concludes that " the desire to do topical searching has not diminished, but that the penalties incurred by the user in the process of using the subject index have led to the decline in use". Even CLR survey found that the topical searching is more prevalent among those who are less experienced with the library and its catalogs (Mathews, et. al., 1986).

O'brien (1994, p223) says that the "...subject indexing of monographs is both superficial and inadequate" as they lack in-depth treatment particularly for composite books and conference volumes as well as lack of TOC, blurbs, etc. Larson (1991) suggests remedies to problems of subject searching which are grouped under (i) the database (ii) the search processing and retrieval algorithms and (iii) the user interface. The database related remedies include expanding records by adding words from TOC, index and blurbs of books, enhancing records with terms from classification schemes and increasing the number of descriptors per book. The second group of remedies include limiting search results by Boolean intersections using additional terms or dates, partial matching and stemming of keywords, relevance ranking of outputs, automatic mapping from input search terms to controlled vocabulary terms through thesaurus look-up, automatic spelling correction or phonetic matching of terms and relevance feed back. The last group of remedies relating to user interface include 'browsability' of existing subject headings using online thesaurus and classification assignments. However, in the context of digital libraries Lesk (2003) questions the very need for traditional subject classification and indexing (which are usually meant for a possible future query) when the actual query itself can be searched on demand in seconds. Multistage searching and display, saving searches, set building, etc. are considered as no more required in the Web and future digital libraries. The new bibliographic model FRBR (The Functional Requirements for

Bibliographic Records) of OCLC has some hopes for subject access by way of suggesting retrieval of groups of related documents. This program is suppose to generate sets of records that can be grouped for display as single works irrespective of their manifestations.

In a transaction log analysis of OCLC online catalogs Tolle (1983) worked out correlation coefficients for transaction search patterns and found that the probability of going from 'begin' state to 'browse' is the highest (0.643) and going from one 'error' to another 'error' state is the next highest (0.598). In other words, once an error was made, the next transaction/command was an error in 59.8% of times. Hardly less than 9% moved from an error state to ending the session. This speaks of user frustration and waste of lot of efforts of end-users.

The degree of variability of subject searching in an OPAC at a university library revealed

that subject searching varied from 22% to 74% over the hours of the day, from 17% to 64% over the days of the week and from 12% to 70% over weeks of the semester (Kaske, 1988a, 1988b). A more recent questionnaire based survey (Oduwole, A A et.al, 2002) of use of OPAC by 286 users at a Nigerian University found that OPAC was used mostly for self search rather than delegated search with author as major (59%) access point followed by subject (30.8 %) and large majority were found very satisfied (75%) with the OPAC.

Important findings:

- Too many failed searches or no records retrieved
- Retrieve unmanageably large number of records
- Navigational frustrations
- Failure to match the system's subject vocabulary
- Recall of subject browsing displays
- Users' search requests/ terms are too broad or too narrow
- Inadequate / lack of cross references
- No Boolean queries formulated
- Lack of user perseverance
- Users make a variety of errors when entering a search request
- Too few subject headings per bibliographic record (Average bibliographic record contains less than 2 subject headings)
- Too many or too few bibliographic records linked to a subject heading

Extensive review of past OPAC use studies is neither feasible nor desirable. However, some of the important findings and suggestions are summarized in the adjacent boxes.

3. BACKGROUND OF THE STUDY

An observation-based study of use of card catalogue of ISRO Satellite Centre (ISAC) library carried out during 1985 (Sridhar, 1986) revealed that classified catalogue was not used, report number catalogue (which is like classified catalogue for reports) was negligibly used, author and title catalogues were moderately used and subject catalogue was heavily used. The library was automated during early 80s and the OPAC was made available on LAN from 1991. A study (Sridhar, 2004) of use

Suggestions for improvements :

- Records enhanced with table of contents (TOC), publisher summary (blurbs), index terms, chapter summary, MARC records, etc.
- Allow use of natural language search
- Provide additional search aids/ assistance tools like search trees
- Use information visualisation software and user interface
- Provide front end database
- Provide access to classification information
- Point the user from keywords to subject headings
- Clean up bibliographic records
- Utilize authority control
- Review frequency of assigned subject headings

of OPAC based on observation, interaction with users and recording by professional staff at the site is done for over 80 hours (equivalent of 10 working days or two working weeks) with due representation for all times of the day and all days of the week during July-August 2002. Unfortunately, the new software does not provide for collecting transaction log data of OPAC. At the time of study, OPAC (2002) had over 2 lakh records. Surprisingly, when the results of this study was compared with that of earlier (1985) card catalogue study, it was found that the quantum of usage of OPAC is not even as much as what it was in case of card catalogue. The data from this study was extracted to further investigate issues and problems relating to decline in subject searching.

4. DATA AND DISCUSSION

The kind of access users prefer while searching OPAC as well as card catalogue are very interesting and probably more revealing for development of search tools and techniques. The above mentioned study (2004) based on critical incident observation has primarily aimed at knowing the approaches of users of ISAC library while searching OPAC. Table I and Figure 1 present the statistics relating to different approaches adopted by users for searching / querying the system. Also juxtaposed in the Table and the corresponding Figure is the data from previous study of use of card catalogue in 1985 (Sridhar, 1986). The data reveals that the title approach is adopted by a maximum of 38.3% while using OPAC as against a maximum of 54.2% adopting subject (descriptors) approach in the card catalogue case. It may be noted that additional search features/ approaches like KWIC and combination searches were obviously not found in card catalogue and hence the magnitude of subject search on OPAC can be assumed to be 33% after adding the KWIC and combination searches. Even then the subject searches have substantially dropped from the time of card catalogue to OPAC days. This is in conformity with the findings of the past studies. As noted earlier, there is generally a small but significant decline in controlled subject searching in favour of keyword (free text) searching (Larson, 1991c). However, even the percentage of searches on author catalogue has dropped from 35.4% in card catalogue to 26.8% in OPAC. This also conforms to the findings of Norden, et.al.

(1981) that title searches were most frequent and the ratio of title to author searches was higher than that in card catalogue. Assuming that specific item searches are mostly non-subject searches, Hirst (1999) through a questionnaire survey of users with different levels of IT expertise, found that OPAC searches were mainly conducted for specific items and that most were successful. In the present study, hardly 2.5 % of searches are `combination` searches. These kind of advanced searches are expectedly done by very few end-users and this trend also conforms to the findings of most of earlier studies of OPAC.

Take in Table I and Figure 1

Concentrating only on major approaches, namely title, author and subject and merging data relating to KWIC searches into that of subject searches, the same data extracted from Table I is presented in Table II. This table together with Figure 1 relating to title, author and subject searches present an interesting comparison of findings of use of OPAC with that of card catalogue. Firstly, searches by title have substantially increased from mere 8.3 % in card catalogue to 38.3 % in OPAC. Secondly, subject searches have dropped substantially from 54.2% in case of card catalogue to mere 30.7% (including KWIC searches) in OPAC. However, author approach has marginally dropped (from 35.4% to 26.8%) from card catalogue to OPAC days. On the contrary, subject searching constituted the majority (59%) in CLR project (Mathews, et.al., 1983).

Take in Table II

A follow up observation of 51 subject searches made by end-users are depicted in Table III. The data revealed that nearly half of them have met with failure. The rest of little over half of searches (52.9%) were considered reasonably successful searches in getting desired results. Out of those met with failure, nearly one-fourth (23.5%) have abandoned the search having reached failure. Another one-fourth (23.5%) changed the search strategy. Out of those who changed search strategy, 13.7% changed keywords.

Take in Table III

It has been very clear from the results of the past studies that the majority of end-users face problems with subject searching and one of the major issues is concerned with the selection of appropriate standardized descriptors by end-users. It is also clear that users do not prefer searching by classification numbers and there is no online help regarding thesaurus and/ or classification scheme. There is a need to create link between classification numbers and the corresponding descriptors. Further, too many or too few bibliographic records are linked to a subject heading as well as too few subject headings are assigned per record (average 2) and hence there is a need to review the frequency of assigned subject headings. Table IV depicts an analysis of descriptors in 920 books from 20 sample class numbers at ISRO Satellite Centre library. Surprisingly, the average number of descriptors assigned per book varied from as low as 1.39 in case of Safety related books to a moderate 2.75 in case of Solar Physics/ System related books with overall average a meager 1.89. Further, the SD is also very low. In other words, much against the cry that more descriptors need to be assigned to the books, the collection continues to be indexed with fewer keywords than desired. The sample books had 599 unique keywords assigned 1737 times. The last column of Table IV depicts ratio of number of unique descriptors to number of books in each subject (class no.). As this ratio

increases the precision of single descriptor search increases. Unfortunately, except few, this ratio is not even one for most of subjects and the highest is just 1.63.

Take in Table IV

An analysis of frequency of occurrence of descriptors in the entire OPAC revealed further surprises. Fifty seven most frequently occurring descriptors appearing 20452 times in OPAC are listed in Table V. Most of descriptors in Table V are very broad topics and unless they are used in post-coordinated or Boolean searches or in combination with other fields, they will result in too many records and become unmanageable for end-users.

Take in Table V

A frequency table of descriptors used for indexing books is depicted in Table VI. ISAC Library uses NASA Thesaurus for indexing books by way of assigning up-to six postable terms from out of 18,100 postable terms listed in NASA thesaurus (which has totally 41,300 entries). It is clear from the table that only 936 descriptors (postable terms) are assigned to more than ten books in a collection of about 39,000 books. In other words, as many as 13,600 descriptors out of 18100 postable terms (i.e., 75.2%) in NASA thesaurus remain unused. It is shocking that professional indexers have made least use of specialized thesaurus meant for space science and technology while indexing books in a space science and technology library.

Take in Table VI

While most frequently used terms (as shown in Table V) cause problems of precision, the unused and least used descriptors (as shown in Table VI) cause problems of recall. As descriptors are drawn from a specialized thesaurus meant for space science and technology, such infrequent (including non use) as well as most frequent use of small set of descriptors appears to be the result of variation in indexing level over time and also from indexer to indexer. The problem may not be uncommon in libraries, but the quality of indexing is a serious concern, if at all subject searching has to be promoted among users. Past research has repeatedly found that failure to match the system's subject vocabulary, recall of subject browsing displays with thesaurus lookup facility and inadequate / lack of cross references as serious drawbacks for subject searching. Obviously many have suggested for allowing use of natural language, providing additional search aids like search trees, pointing users from nonstandard keywords to descriptors, development of ontological and other automatic categorization techniques.

5. CONCLUSION

The search process in online catalogues has more or less remained same as in card catalogue with increased access points, varieties of search features but with increased complexity of the process. End-users are not only expected to have technical searching skills but also conceptual and semantic knowledge relating to query in case of subject searching in order to articulate the query. Both indexing quality and under usage of subject access in OPAC cause serious concern about the so called 'subject approach' to knowledge. Inconsistent indexing quality has made the subject searching further difficult and ineffective. In addition to end-user training and other remedies suggested, total new look into interactive searching like drag and drop text from hits, 'more like this' feature, online thesaurus lookup with classification link, partial matching, auto AND search, etc.

are required. Among many suggestions made to the vendor of software is the provision for indicating the intended use/ application and / or level of book such as beginner, general, specialized / advanced, review, etc., which often helps to improve the precision of the search and utility of the hits in OPAC. Lastly, adding intelligent components like quality addition based on community rating/ use statistics, automatic updation, etc. are necessary.

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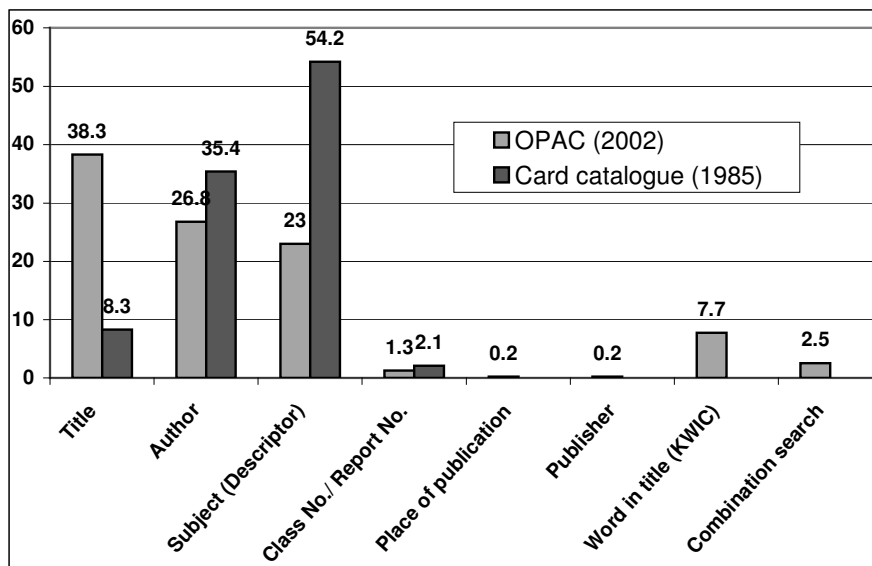
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TABLES AND FIGURE

Type of search/ access	OPAC (2002)		Card catalogue (1985)	
	No.	%	No.	%
Title	150	38.3	8	8.3
Author	105	26.8	34	35.4
Subject (keyword)	90	23	52	54.2
Class No./ Report No.	5	1.3	2	2.1
Place of publication	1	0.2	NA	NA
Publisher	1	0.2	NA	NA
Word in title (KWIC)	30	7.7	NA	NA
Combination search	10	2.5	NA	NA
Total	392	100	96	100

Key: NA, Not applicable

FIGURE 1 Access point/ Approach OPAC and card catalogue



Access point/ type of catalogue	OPAC (2002)	Card catalogue (1985)
Title	38.3	8.3
Author	26.8	35.4
Subject (+KWIC)	30.7	54.2

	No.	%
Successes	27	52.9
Failures:		
- Abandoned	12	23.5
- Changed keywords	7	13.7
- Changed search	5	9.8
Sub total	24	47.1
Total	51	

Table I V *Sample class numbers checked for descriptors*

Sl. No.	Class. No.	Subject	No. of books	No. of descriptors	Average	SD	No. of unique descriptors	Ratio of unique descriptors to books
1	523.9	The Sun, Solar physics	24	66	2.75	1.27	39	1.63
2	528.8	Remote sensing	79	156	1.97	1.21	50	0.63
3	537.8	Electromagnetism, Electromagnetic field, Electrodynamics, Maxwell theory	52	86	1.65	1.26	28	0.54
4	539.216.2	Films, Thin films	24	35	1.46	1.00	14	0.58
5	614.8	Accidents prevention, Protection safety	28	39	1.39	0.88	21	0.75
6	621.3.049.7	Printed circuits and the like	10	21	2.10	0.89	11	1.10
7	621.314.5	Conversion of AC to DC & vice versa, convertors, invertors	17	41	2.41	1.18	20	1.18
8	621.38.049.771.1							
8	4	Microprocessors	243	409	1.68	1.10	68	0.28
9	621.37.04	Microelectronics	32	71	2.22	1.11	28	0.88
10	621.381.542	Image analysis	30	71	2.37	1.57	38	1.27
		Barrier layer photocells, Photovoltaic cells, Photodiodes, Phototransistors						
11	621.383.5		15	23	1.53	0.65	6	0.40
12	621.396.67	Aerial systems	79	150	1.90	1.86	55	0.70
13	621.390.96	Radar	58	107	1.84	1.92	55	0.95
14	629.7.036.5	Rocket propulsion	8	18	2.25	1.44	13	1.63
15	629.73	Aeronautical engineering	25	48	1.92	1.27	28	1.12
16	629.785	Space probes	21	52	2.48	1.01	21	1.00
17	658.562	Quality control	65	110	1.69	0.58	22	0.34
		Design, construction layout of DP systems						
18	681.3.02		77	177	2.30	1.01	62	0.81
19	681.3.06vhd	VHDL (computers)	15	25	1.67	0.36	9	0.60
20	681.351	Computer networks	18	32	1.78	0.40	11	0.61
Total			920	1737	1.89		599	0.65

TABLE V *Ranked list of descriptors in books*

Rank	Descriptor	No. of Books
1	Computer programming	1127
2	Computer networks	748
3	Signal processing	745
4	Software engineering	610
5	Integrated circuits	577
6	Programming languages	534
7	Control theory	520
8	Neural nets	515
9	Artificial Intelligence	510
10	Communication networks	470
11	Aerospace Engineering	468
12	Computers	457
13	Micro processors	433
14	Remote sensing	426
15	Data processing	418
15	Image processing	418
17	Robotics	404
17	Telecommunication	404
19	Data base management systems	368
19	Dictionaries	368
20	Indexes (Documentation)	349
21	Computer aided design	343
22	Astronomy	341
23	India	340
24	Circuits	329
24	Electrical engineering	329
25	Very large scale integration	328
26	Communication	324
26	Micro computer	309
27	Computer programs	303
28	Multimedia	299
29	Management	285
30	Antennas	281
31	Libraries	279
31	Wireless communication	279
33	Computer graphics	271
34	Industries	266
35	Quality control	264
36	Expert systems	263
36	Operating systems (computers)	260
37	Architecture (computers)	259
38	Internets	257
39	Heat transfer	248
40	Bibliographies	247
41	Manufacturing	246
42	C (Programming Language)	245
43	Robots	238
44	Medical science	234
45	Algorithms	220
45	Electronic equipment	220
47	Lasers	217
47	Reliability	217
48	C++ (Programming Language)	213
49	Databases	207
49	Micro waves	211
50	Propulsion	206
51	Object-oriented programming	205
Total	(57 Descriptors)	20452

TABLE VI *Descriptors with least number of records/ books (Frequency distribution of least assigned descriptors)*

No. of descriptors	No. of Books (Records)
1,539	1
658	2
367	3
281	4
196	5
159	6
122	7
93	8
70	9
75	10
Sub-total	3,560
	936 >10
	13,004 (unused) 0
Total	18,100

About the Author

Dr. M.S.Sridhar is a post graduate in mathematics and business management and a doctorate in library and information science. He is in the profession for last 35 years. Since 1978 he is heading the Library and Documentation Division of ISRO Satellite Centre, Bangalore. Earlier he has worked in the libraries of National Aeronautical Laboratory (Bangalore), Indian Institute of Management (Bangalore) and University of Mysore. Dr. Sridhar has published four books ('User research: a review of information-behaviour studies in science and technology', 'Problems of collection development in special libraries', 'Information behaviour of scientists and engineers' and 'Use and user research with twenty case studies') and 74 research papers, written 19 course material for BLIS and MLIS, presented over 22 papers in conferences and seminars, and contributed 5 chapters to books.

