Research Notes

End-User Training in the Use of a Small Swedish Database

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INTRODUCTION

In recent years there has been a considerable increase in the availability of computer-stored information both in bibliographic and nonbibliographic databases.[1,2] This increase in online information has resulted in a need to teach people how to use the available facilities. As Lancaster pointed out in 1973,

> a critical factor affecting the success or failure of an on-line information retrieval system is the effectiveness of the procedures employed to teach people how to use the facilities.[3]

Several groups are concerned with online orientation, training, and education: (1) database producers; (2) systems operators; (3) institutions responsible for terminal operation for example libraries or information centres within academic institutions; (4) library schools; (5) intermediaries; (6) end-users.

This paper will describe how a group of end-users (engineering undergraduates) were taught to carry out interactive online searching on a small, specialized Scandinavian database. Their search techniques and attitude to online searching will be examined and evaluated.

THE BYGGDOK DATABASE

The BYGGDOK database has been developed and built up by the Swedish National Building Documentation Centre.[4] BYGGDOK is a bibliographic database containing some 25,000 references (with an annual growth rate of 5,000). The database covers the highly specialized field of building and construction with references dealing with the following subjects: architecture, building materials, building planning, civil engineering, construction technology, environmental technology, installation technology, and urban planning.

Input to the database is mainly Scandinavian material, in the form of journal articles, reports, product information standards, etc. The abstracts are written in the language of the country of origin (mainly Swedish, Danish, or Norwegian). Each reference is described with Swedish keywords. The database can, however, be used by persons with no knowledge of Swedish, by means of a reduced UDC (universal decimal classification) code system developed by the Swedish National Building Documentation Centre.

BYGGDOK is available to users throughout Scandinavia via SCANNET, the Nordic data network. The database is widely used by practising engineers and architects. The concentration on Scandi-

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navian material is regarded as being very practical, due to the differences in building standards between Scandinavian and other countries.

LIBRARY USER EDUCATION PROGRAMME AT CHALMERS UNIVERSITY

Chalmers University Library developed, from 1974 to 1980, an extensive user education programme[5] that can be divided into the following stages:

1. Orientation for new users.
2. A fourteen-hour introduction to information retrieval for third- and fourth-year engineering undergraduates.
3. Advanced courses in information retrieval (including computerized methods) for doctoral students—a seventy-hour course.
4. Courses for practising engineers, laboratory assistants, etc.

In 1980, Chalmers Library received a grant from the Office of the Chancellor of Swedish Universities to investigate the possibility of teaching end-users how to carry out direct online searches on BYGGDOK. More than 300 undergraduates from the schools of civil and mechanical engineering have so far taken part in practical online training. The BYGGDOK online training programme will be described in the following sections.

GOALS AND OBJECTIVES FOR THE BYGGDOK ONLINE INSTRUCTION

The main goal for the undergraduate online programme was to enable the student to carry out online information searches within a subject field on the BYGGDOK database as, and when, required in connection with information needs.

Specific objectives were described as follows—after completing the course the end-user should:

1. Be aware of different methods for information retrieval: manual, batch processing, SDI, and interactive online.
2. Be aware of different kinds of information searches: current awareness, retrospective, factual.
3. Be able to carry out logging-on procedures for a network database.
4. Be able to use a teletype or VDU (visual display unit) terminal.
5. Be able to use the basic commands and features of the BYGGDOK retrieval system.
6. Be familiar with a typical unit record.
7. Be able to express a search topic in suitable terms and parameters.
8. Be able to develop a search strategy in terms of Boolean logic.
9. Be able to evaluate the results obtained.

TEACHING METHODS CHOSEN AND ORGANIZATION OF COURSE

There is a wide variety of methods and media available for online teaching. A selection of methods was used—lectures, small group seminars and demonstrations, audiovisual demonstrations, printed manuals and checklists, and direct "hands-on" training. The introductory course lecture was used to present a frame of reference, with emphasis on the patterns of communication and the relationship between computerized information retrieval and manual methods. Different types of information searches were presented. The main part of the course was based on small group methods—laboratory sessions with demonstrations and practical searches on a topic of the student's own choice.

The first laboratory session (five hours) was mainly devoted to manual information searching, using a variety of tools. The last hour was used for an orientation on computerized information retrieval using audiovisual, multimedia MEDIATRON programmes. The MEDIATRON teaching aid was developed at the Central Information Service of the University of London by Vickery and Pratt.[6] The MEDIATRON is a modified stereotape recorder that is designed to carry out simultaneous recordings of audio commentaries, trigger pulses for photographic slides, and digital signals from computerized information retrieval systems. A multimedia online-orientation programme was produced using synchronized slides, audio commentaries, and recorded digital signals (examples of a search). This online orientation was displayed via slide projector, loudspeaker, VDU, and monitors.

The BYGGDOK database was described and demonstrated. Students were then given a short manual that introduced computerized information retrieval, described the BYGGDOK database, logging-on techniques, the search command language, and search techniques. They were told that at the next session, in a week's time, they would carry out their own hands-on search.

The second laboratory session started with a short review, including a MEDIATRON demonstration programme of BYGGDOK. Students then prepared their searches, planning strategies with the aid of search-term frequency lists. They usually worked in groups of two or three persons. The group then carried out their search on a teletype terminal, with a BYGGDOK checklist of commands immediately adjacent to the terminal.

On completion of the course the students handed in a list of references relevant to their search topic, found by means of both manual and online searching. They also presented copies of their online search in which the references obtained were assessed for relevance and novelty.

EVALUATION

Evaluation of the online learning was carried out in a number of ways:

1. Students were asked to complete a questionnaire about:
- overall gain from the course
- the teaching material used
- the practical terminal sessions
- future use of the BYGGDOK database and of online searching
- the teaching methods used

2. Direct observation of how the end-users managed to log on and off and carry out a search.

3. Comparative search analysis with regard to:
- the process (search effort)
- the product (in terms of recall and precision)

A number of end-user searches were repeated by a trained BYGGDOK intermediary. Searchers' efforts were compared with respect to:
- Numbers of commands used
- Different types of commands used
- Numbers of search descriptors
- Sets viewed (any set which was requested for display or printing)
- Search modification
- Errors made
- Connect time

The choice of these parameters was based on measures for discrimination among users with different levels and experience of online searching described by Fenichel in 1979.[7] The searches were also compared with respect to recall and precision.

QUESTIONNAIRE RESPONSES

Students were asked to state their opinions as to "overall gain" from the course, on the new teaching material produced, and were asked to evaluate the practical terminal sessions (see tables 1–3).

In addition, students were asked to state their attitudes to this kind of training in computerized information retrieval (see table 4). For comparison, a group which had merely received online orientation is included.

Students were asked if they thought they would use the BYGGDOK database at some future time. Fifty-five percent thought they would use the database, 3 percent thought it too expensive, and 42 percent were not sure. Eighty-four percent stated that, if they had access to a terminal, they would like to carry out their own online searching in the future, whereas 17 percent were not sure about this. Eighty percent of the students said that they preferred computerized information retrieval to manual methods. Reasons given were speed, convenience, and flexibility. A number of students pointed out that it was possible to combine more search terms in computerized searching

TABLE 1
"OVERALL GAIN" FROM COURSES IN INFORMATION RETRIEVAL

"Overall Gain"	Online Course 1980 %	Manual Course 1975 %
Very good	17	15
Good	67	58
Satisfactory	16	24
Little	0	3
Nothing	0	0
	(N = 70)	(N = 220)

TABLE 2
OPINIONS ABOUT TEACHING MATERIAL AND MEDIA

	BYGGDOK Manual	MEDIATRON Demonstration	Checklist
Very good	14	9	19
Good	73	47	61
Satisfactory	12	36	20
Hardly satisfactory	0	8	0
Unsatisfactory	0	0	0

TABLE 3
PRACTICAL TERMINAL SESSIONS

Attitudes to		Difficulty	
Very good	23%	Very easy	23%
Good	70%	Easy	63%
Satisfactory	6%	'About right'	14%

TABLE 4
DO YOU THINK THIS IS A GOOD WAY FOR TEACHING ABOUT ONLINE INFORMATION RETRIEVAL?

	1980 (Includes Practical Searching)	1978 Orientation Only
Very good way	61%	10%
Good way	38%	66%
No opinion	1%	9%
Not particularly good	0%	7%
Not a good way	0%	0%

than by use of the manual tools. One particularly interesting fact that emerged from the evaluation was that students were themselves evaluating the different approaches. This can be illustrated by the following comments:

"Both manual and computerized searching are useful. Online techniques are convenient and quick: manual searching allows a rapid glance through subject headings in an index. You need to combine both methods."

"You can't say that you prefer manual or computer searching. They have different advantages and disadvantages. The computer's strength is in its speed, and the fact that the references are printed out. In manual searching it is easy to limit a search by suitable choice of search term."

"The database contained only a limited amount of information—we found more foreign language references by manual methods."

"Both methods are necessary."

"I found more references through manual searching. It is important to know how to perform manual searches, as many libraries don't yet have terminals for computer searching. Computer methods were interesting and I enjoyed the searching."

Observations

All the students (some 300) who have so far taken part in online training sessions, have managed to carry out the various logging-on procedures and terminal searching. In the first sessions the main difficulty was finding the *On/Off* switch on the terminals. (This was easily remedied by writing *On* and *Off* marks in large red letters on the appropriate parts of the machine!) Most of the students worked in small groups, and this appeared more satisfactory than individual terminal work. In cases of difficulty the group could often work out a joint solution, whereas individual searchers tended to ask the assistant in charge of the session for advice.

There was no doubt that the students enjoyed the terminal sessions. Often it was difficult to stop students searching! This sometimes led to grumbles amongst those waiting. We increased the number of terminals from two to four in order to

limit waiting time. A considerable number of students have come back to the library and asked to carry out an online search in connection with some other project.

Comparative Search Analysis

Eleven end-user searches were compared with similar searches carried out by a trained BYGGDOK intermediary. The latter not only had extensive experience in searching, but also in input and construction of BYGGDOK. She was conversant with the use of search techniques based on the special reduced UDC code developed at the Swedish Institute of Building Documentation for this purpose. It should be noted that the students had not been taught the use of the classification code for their online searching. At the same time, the control searches were carried out in the absence of an end-user, so that the interactive relevance judgement of the user was missing. The intermediary said that, as a non-engineer, she experienced some difficulty in relevance judgements. The student group was highly motivated, as they were searching for information needed for their research projects. With respect to external conditions, variables such as type of terminal, search tools, database, and search command language were controlled and identical. System response varied to a small extent from search to search. Comparisons of search efforts between end-users and intermediary are shown in table 5.

From this table it can be seen that end-users expended greater efforts on searching than did the intermediaries. The latter carried out short, economical searches. The end-users showed considerable determination and flexibility in their attempts to obtain relevant references from the BYGGDOK database, with repeated restarts and the use of a variety of descriptors. Their inexperience can be seen in the errors (four per search) and in the dominance of use of non-truncated descriptors with respect to truncated terms. The experienced intermediary made greater use of truncated descriptors. Connect time was greater for end-users than for the experienced intermediary.

Results of end-user and intermediary searches were compared with regard to recall and precision. These are defined as follows:

$$\text{Recall} = \frac{\text{No. of relevant references retrieved}}{\text{Total no. of relevant references in the database}}$$

$$\text{Precision} = \frac{\text{Relevant references retrieved}}{\text{Total no. of references retrieved}}$$

The search results are seen in table 6.

Recall is surprisingly high for the end-user group. This may be connected with their search motivation and aforementioned determination to obtain references. Precision was considerably lower for the end-user group than for the intermediary.

TABLE 5
COMPARISON OF SEARCH EFFORT—BYGGDOK SEARCHES

Search Effort Variable	End-Users*	Intermediary*
Total no. of commands used	26	8
Different types of commands	8	5
Total number of descriptors searched	11	4
Number of truncated descriptors searched	4	1
Number of non-truncated descriptors searched	7	2
Unique descriptors	8	4
Sets viewed	3	1
Errors/search	3	0
Connect time	<	>

*Average/search

TABLE 6
COMPARISON OF SEARCH RESULTS

Search Product Variables	End-Users	Intermediary
Recall	62%	80%
Precision	46%	76%

This factor is perhaps of less importance in the use of a small database than with a larger one.

DISCUSSION AND CONCLUSION

Most of the teaching/learning activities on computerized IR for nongraduates has been directed towards orientation and promotion—by means of demonstration searches and lectures. There is, however, evidence to show that new users can learn to perform searches after a short period of training. Engineering and science undergraduates are, today, in many cases, competent in the use of terminals for online computations and simulations. It seemed, therefore, reasonable to test the hypothesis that end-users could be trained to carry out their own interactive online searches using one system (and command language) and a limited number of databases.

This paper describes how a group of seventy civil engineering undergraduates were trained to use a small Swedish database—BYGGDOK—for online searching. The students achieved surprisingly good recall values, in comparison with an experienced intermediary. The students expressed very positive attitudes towards online information retrieval—84 percent said that if they had access to a terminal, they would like to carry out their own online searching in the future. The online training appears to have increased awareness of methods of information retrieval—not only computerized but also manual methods. ("You can't say that you prefer manual or computer searching. They have different advantages and disadvantages . . .")

The positive experience from this experiment led to the introduction of hands-on online training for a group of 200 mechanical engineering undergraduates, in 1981, on MechEn—a database produced at the Royal Institute of Technology, Stockholm. Two further groups of civil engineering undergraduates, and a smaller group of postgraduates, have received training in the use of BYGGDOK.

It is hoped to extend this type of training for students of architecture and engineering chemistry, so that online searching becomes a regular part of courses in information retrieval. Search results obtained by end-users will be compared with those obtained by intermediaries. It is hoped that these analyses will provide useful information about possible differences in search behaviour between new users and experienced intermediaries. This type of information can then be used to modify and improve existing teaching programmes. One example of this formative evaluation can be seen in the relative prevalence of nontruncated descriptors in the searches of the civil engineering students. In future training, more emphasis will be placed on the use of truncation to simplify search techniques.

It is important to study whether end-users can be taught to carry out online searching themselves, or whether all searches are best performed by an intermediary. It is often argued that intermediary performed searches are more cost-effective than those of end-users. Cost-effectiveness is sometimes expressed in terms of *unit cost* where:

$$\text{Unit cost} = \frac{\text{Connect time}}{\text{No. of relevant references retrieved}}$$

This measure of cost-effectiveness is, however, limited. In the world of the practising engineer or scientist, time is precious, and a truer measure of cost-effectiveness would be:

$$\text{Cost-effectiveness} = \frac{\text{Time used by engineer}}{\text{No. of relevant references}}$$

In the intermediary-performed search, this increases with distance from online search centre. We conclude that it is possible to train undergraduate engineering students (who will soon be practising engineers) to carry out searches based on one information system (and common command language) for a limited number of databases. With user-friendly interfaces, it seems reasonable to suppose that end-users will be increasingly able to carry out their own information searches in the future. The role of the intermediary, in turn, might well develop from that of individual searcher to that of adviser and con-

sultant, with specialized knowledge for transdisciplinary or exhaustive searches.

If you give a man a fish
He will have one meal
If you teach him to fish
He will be fed for life

—Old Chinese Proverb

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