

4-1989

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Repository Citation

Markert, R. J., Parisi, A. J., Barnes, H. V., Cohen, S., Goldenberg, K. X., Mieczkowski, L. E., & Dunn, M. M. (1989). Medical Student, Resident, and Faculty Use of a Computerized Literature Searching System. *Bulletin of the Medical Library Association*, 77 (2), 133-138.
<https://corescholar.libraries.wright.edu/surg/226>

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Medical student, resident, and faculty use of a computerized literature searching system

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The experiences of medical students, residents, and faculty with a computerized literature searching system were evaluated. Third-year medical students, internal medicine and family practice residents, and full-time and voluntary faculty at one medical school had the opportunity to use a full-text and bibliographic medical literature retrieval system free of charge for an eleven-month period. Subjects conducted nearly nine thousand literature searches over a period of 942 system hours. Questionnaire data showed that participants could learn to use and would use an electronic information system, felt capable of using the system, utilized the system for a variety of purposes and in a number of different ways, and viewed the system as a valuable tool in searching the medical literature. The results are discussed in the context of the educational needs of the four user-groups and medical education planning by institutions.

The exponential growth of medical literature in recent decades has challenged the ability of practicing physicians and medical researchers to deal with the rapidly increasing quantity of medical information [1]. Computerized literature searching enables the user to efficiently identify germane articles and research studies. Physicians can learn to use a computerized literature searching system and effectively retrieve material related to patient care [2-3]. In medical education the literature also functions as source material for conference presentations, course and licensing examinations, teaching assignments, and research studies. Authorities in medical information science have

recommended the acquisition of computerized literature searching skills across the continuum of medical education—undergraduate, postgraduate, and continuing education [4-6]. Collen and Flagle [7] found that an online, full-text and bibliographic medical retrieval system was effective with a group of staff physicians, residents, medical students, nurses, and

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librarians. Others [8-10] have also reported on the value of electronic information systems in academic medical centers. Simon [11] compared two computerized literature searching programs by randomly assigning students to two different literature searching programs during the pediatric clerkship, and, in a brief communication, Rodnick and colleagues [12] described the effectiveness of MEDIS in teaching medical students to conduct bibliographic searches.

The present evaluation study investigated (a)

whether medical students, residents, and faculty could learn to use a computerized literature searching system, (b) how extensively they would use the system, (c) for what purposes they would use the system, and (d) the procedures by which they would use the system.

METHODS

The computerized literature searching system used in the current study was Mead Data Central's MEDIS. MEDIS yields full-text of both journal articles and textbooks, abstract-summary, or citation retrieval. The MEDIS user can be trained in two one-hour sessions to enter and combine the words, phrases, and numbers which allow the user to access the system and retrieve information.

The system was available to third-year clerkship students ($n = 104$), internal medicine and family practice residents ($n = 54$), and faculty (212 full-time; 1,063 voluntary) at the Wright State University School of Medicine (WSUSOM) from December 1986 through October 1987. Six hospitals were equipped with terminals for electronic literature searches. A terminal with printer was placed at each hospital separate from the library in a location that provided 24-hour access. In addition, faculty, residents, and students could access the system at home on their own PC's with software provided at no cost to the user. Prior to initiating the program, all medical students, residents, and faculty were offered instruction on system operation and search strategies by a team composed of vendor personnel and experienced faculty. Many students were familiar with the system from having completed a preclinical elective on computers in medicine. A limited number of residents and faculty had previous computerized literature searching experience. Students, residents, and faculty could access the system at no cost since WSUSOM funded the project.

Third-year medical students were required to perform literature searches using the system to aid in conference preparation and patient evaluations during their clerkships. The requirements varied from rotation to rotation, ranging from once per week in medicine to once per clerkship for pediatrics. For each required use, the student completed a "Patient Write-Up References" form (Appendix A) documenting how and to what degree the electronic literature search helped in the preparation of necessary material. In addition to the required use, the students were encouraged to use the system as often as possible. Residents and faculty were not required to use the system.

The system automatically clocked the hours (connect time on the system) and number of searches. During December 1987 and January 1988, students, residents, and faculty were asked to complete a ques-

tionnaire (see Appendices B and C) which recorded their perceptions about the system.

RESULTS

Response rates for the questionnaire were: medical students (75 of 104, 72.1%), residents (22 of 54, 40.7%), full-time faculty (117 of 212, 55.2%), and voluntary faculty (350 of 1,063, 32.9%). All student and resident respondents had used the system, while 46 (39%) full-time and 44 (13%) voluntary faculty respondents were users.

The questionnaire asked if respondents felt capable of using the system. On a 1 to 5 scale ("strongly disagree" to "strongly agree"), the mean ratings were: medical students 4.25, residents 3.57, full-time faculty 4.03, and voluntary faculty 3.86 (see Table 1). The overall mean was 4.04. Thus, medical students, residents, and faculty were able to learn the system for computerized literature searching.

For the eleven-month period (December 1986 through October 1987), medical students, residents, and faculty used the system for 942 hours (an average of 86 hours per month). For the same period, users conducted 8,967 literature searches (an average of 815 searches per month). Furthermore, 50% (93 of 185) of respondents used the system ten or more times during the eleven-month period (see Table 1).

The questionnaire asked respondents to indicate the purposes for which they used the system (see Table 2). A high percentage of medical students used the system for patient write-ups (87%), personal interest or curiosity (85%) and conferences or other presentations (84%). The educational requirements of their clerkships resulted in medical students using the system to access textbook material to a far greater extent than residents or faculty. Like medical students, residents used the system extensively for conferences and other presentations (86%) and personal interest or curiosity (82%). Full-time faculty's most frequently cited reason for using the system was research or scholarly writing (72%); conversely, voluntary faculty cited this purpose least often (27%). Both full-time (61%) and voluntary (64%) faculty often used the system to prepare for conferences or other presentations. Full-time faculty more frequently used the system to prepare for teaching than voluntary faculty (57% versus 36%). Personal interest or curiosity was cited by nearly one-half of both faculties (48%). Voluntary faculty (59%) were more likely to use the system for patient care than full-time faculty (39%).

The system enabled the user to generate the full-text of a journal article or textbook in addition to citations and abstracts. Thus, it was of interest to determine which of seven procedures medical students, residents, and faculty used most often (see Table 3).

Table 1
Questionnaire results for medical students, residents, and faculty

	Medical students	Residents	Full-time faculty	Voluntary faculty
Number surveyed	104	54	212	1,063
Number responding	75	22	117	350
Percent responding	72.1	40.7	55.2	32.9
Number of respondents who used the system (%)	75 (100)	22 (100)	46 (39.3)	44 (12.6)
Felt capable of using the system	4.25*	3.57*	4.03* (n = 46)	3.86* (n = 42)
System viewed as a helpful tool in using medical literature	3.90*	3.43*	4.09* (n = 46)	3.95* (n = 43)
Times used the system during 11 month period (%)				
None	1 (1)	1 (5)	0 (0)	2 (5)
1-3	0 (0)	4 (18)	15 (33)	17 (40)
4-6	7 (9)	4 (18)	5 (11)	10 (23)
7-9	14 (19)	4 (18)	3 (7)	5 (12)
10 or more	52 (70)	9 (41)	23 (50)	9 (21)

* 1 = strongly disagree; 5 = strongly agree.

The most frequently cited procedure for all groups was reading the abstract on the screen: medical students (88%), residents (82%), full-time faculty (78%), and voluntary faculty (64%). The second most frequent procedure for students was finding hard copy of the articles after the system was used to identify material of interest (80%). This was the voluntary faculty's fourth choice (39%). Only one-half of the residents and fewer than one-half of the full-time faculty (43%) used this procedure. Table 3 shows that the four groups varied considerably in their other preferences. It is noteworthy that all seven procedures were used by at least 20% of all four groups.

Table 2
Purposes for which medical students, residents, and faculty used the computerized literature searching system (number and percent)

Purpose	Medical students n = 75	Residents n = 22	Full-time faculty n = 46	Voluntary faculty n = 44
Patient write-ups/ patient care	65 (87)*	3 (14)*	18 (39)**	26 (59)**
Conference/other presentation	63 (84)	19 (86)	28 (61)	28 (64)
Study for examination	6 (9)	0 (0)	—	—
Teaching	—	—	26 (57)	16 (36)
Research/scholarly writing	—	—	33 (72)	12 (27)
Personal interest/ curiosity	64 (85)	18 (82)	22 (48)	21 (48)

* Patient write-ups.

** Patient care.

— Not appropriate.

Respondents were asked on a 1 to 5 scale ("strongly disagree" to "strongly agree") if they viewed the system as a helpful tool in using the medical literature. The mean ratings were: medical students 3.90, residents 3.43, full-time faculty 4.09, and voluntary faculty 3.95 (see Table 1). The overall mean was 3.89. Thus, medical students, residents, and faculty saw the system as valuable in utilizing the medical literature.

In addition, medical students and residents were asked to indicate how helpful the system was in locating material which dealt with different components of patient care. On a 1 to 5 scale (1 = "not helpful," 5 = "very helpful"), the following were rated: signs or symptoms, pathophysiology of disease, differential diagnosis, complications, diagnosis/lab evaluation, and therapy. Table 4 reports these results. Medical students found the system to be most helpful for therapy (4.21) and pathophysiology of disease (4.17), while complications (4.05), therapy (3.86), and pathophysiology of disease (3.86) were rated highest by residents. Signs or symptoms were rated lowest by both students (3.50) and residents (3.14).

DISCUSSION

This study has demonstrated that groups along the continuum of medical education can learn and will use a computerized literature searching system. The four groups investigated in this study (medical students, residents, full-time faculty, and voluntary faculty) differed in their assessment of an electronic system. Medical students felt most capable of using the system, while residents felt least capable. This may have been due to greater utilization of the system by

Table 3
Procedures by which medical students, residents, and faculty used the computerized literature searching system (number and percent)

Procedure	Medical students n = 75	Resi- dents n = 22	Full-time faculty n = 46	Voluntary faculty n = 44
Read the abstract on the screen	66 (88)	18 (82)	36 (78)	28 (64)
Read the article on the screen	43 (57)	5 (23)	9 (20)	14 (32)
Obtained the abstract as output from the printer	52 (69)	8 (36)	25 (54)	21 (48)
Obtained the article as output from the printer	44 (59)	12 (55)	9 (20)	15 (34)
Had the library reproduce abstracts or articles after identifying material of interest	19 (25)	11 (50)	20 (43)	25 (57)
Found the articles myself after identifying material of interest	60 (80)	14 (64)	25 (54)	17 (39)
Generated a bibliography for a topic	41 (55)	11 (50)	34 (74)	15 (34)

students since it was a requirement in the student clerkship. Similarly, full-time faculty's greater use of the system compared with voluntary faculty may have led to full-time faculty feeling more capable of using the system. Conversely, it can be argued that feeling less capable of handling the system led to less use. Faculty and students differed little in their ratings of the system as a helpful tool in using the medical literature, but residents were more skeptical. Perhaps, again, this was due to lower use by residents.

Medical students felt most capable of using the system, while residents felt least capable.

Not surprisingly, the four groups differed in their purposes for using the system. Medical students and residents centered their usage around their educational programs. Students used the system extensively for patient write-ups, conferences or other presentations, and personal interest or curiosity. Similarly, residents were most likely to use the system for conferences or other presentations and personal interest or curiosity. Full-time faculty used the system for activities related to their academic or professional role: research or scholarly writing, conference preparation, and teaching assignments. Voluntary faculty most often used the system for conference preparation and patient care.

The study also examined the procedural uses of the system. The most frequently cited procedure by all four groups was reading the abstract on the screen. The results indicated that all four groups used a variety of procedures in searching the medical literature. Although tests of statistical significance were not performed, it is noteworthy how the four groups

Table 4
Medical students' and residents' ratings of computerized literature searching system as helpful for different components of patient care*

Component	Medical students n = 75	Residents n = 22
Signs or symptoms	3.50	3.14
Pathophysiology of disease	4.17	3.86
Differential diagnosis	3.69	3.52
Complications	3.88	4.05
Diagnosis/lab evaluation	3.94	3.67
Therapy	4.21	3.86

* 1 = not helpful; 5 = very helpful.

differed. For example, medical students were much more likely to read the material on the screen but least likely to have the library reproduce abstracts or articles. Also, full-time faculty were least likely to obtain an article as printer output but most likely to use the system to generate a bibliography. These varying results have implications for medical schools or libraries planning the purchase of a computerized literature searching system to serve different groups within the medical community.

The questionnaire response showed that a small percentage of faculty took advantage of the opportunity to use a computerized literature searching system at no personal expense. For full-time faculty, 117 of 212 (55.2%) responded and only 46 classified themselves as users. These 46 users are 21.7% of the full-time faculty (46 of 212). More strikingly, only 44 of the 350 voluntary faculty respondents indicated they were system users. These 44 are only 4.1% of voluntary faculty (44 of 1,063). Recognizing that some nonrespondents were users, the authors estimate that only one of four or five full-time faculty and one of twenty to twenty-five voluntary faculty chose to use a computerized literature searching system even when it was offered free of charge. This limited use, especially among voluntary faculty, may have been due to lack of awareness of the system's existence. Although all faculty were alerted to the system's availability and the training sessions, there was no major promotional effort to encourage involvement. Lack of convenience in accessing terminals, fear of or unwillingness to learn about computers, or lack of interest in examining the medical literature by computer also may have contributed to the small number of faculty who were users.

The approximate cost for the eleven-month period with 942 hours clocked and 8,967 literature searches conducted would have been \$61,000. Through a grant, however, the actual cost to WSUSOM was \$32,000. WSUSOM users had unlimited access to the system for this amount. Usage by faculty, residents, and stu-

dents may have been enhanced by no charge being attached to individual use of the system. Medical schools and libraries considering a similar program must investigate the various systems on the market, their effectiveness, ease of use, and cost. The decision to adopt a specific system often involves trade-offs among these and other factors. The results of this study can be helpful to institutions planning the acquisition of a computerized literature searching system.

WSUSOM was well pleased with the educational value of this experience with a computerized literature searching system. However, MEDIS is no longer available as a separate system from Mead Data Central. Thus, during 1988 WSUSOM investigated other computerized literature searching systems to incorporate into its educational programs. BRS/Colleague was chosen for the 1988-1989 academic year.

In summary, an assessment of medical students, residents, and faculty who used a computerized literature searching system found that these groups could learn to use and would use an electronic information system. Furthermore, they felt capable of using the system, utilized the system for a variety of purposes and in a number of different ways, and viewed the system as valuable to them in searching the medical literature.

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Received August 1988; accepted November 1988

Appendix A PATIENT WRITE-UP REFERENCES

- What is the patient's working diagnosis?
- What specific question(s) were you seeking to answer in your literature search?
 -
 -
- Attach or list two journal references related to this patient's case. Include first author, title, journal, volume, pages, year.
 -
 -
- Circle one of your two journal references and complete the following for that article:
 - How helpful was the article in understanding

	NOT HELPFUL	FAIRLY HELPFUL	VERY HELPFUL	NOT APPROPRIATE		
signs or symptoms.....	1	2	3	4	5	NA
disease's patho-physiology.....	1	2	3	4	5	NA
differential diagnosis.....	1	2	3	4	5	NA
complications.....	1	2	3	4	5	NA
diagnosis/lab evaluation.....	1	2	3	4	5	NA
therapy.....	1	2	3	4	5	NA
 - Briefly state the single most useful point you learned from this article?
 - Did you locate this article through Medis? Yes No
 - Did you use any of the following in preparing this patient write-up?
 - articles other than the two listed above
 - textbook(s)
 - library staff
 - medical staff
 - other (please specify) _____

Appendix B
MEDIS QUESTIONNAIRE FOR STUDENTS AND RESIDENTS

1. Circle the response which is appropriate for you.

	Strongly Agree	2	3	4	Strongly Disagree
1. I feel capable of using Medis to locate articles in the literature.	1	2	3	4	5
2. Medis has been a helpful tool in my learning to use the medical literature.	1	2	3	4	5
3. How many times have you used Medis?					
a. none					
b. 1-3					
c. 4-6					
d. 7-9					
e. 10 or more					
4. For what purposes did you use Medis? (CIRCLE AS MANY AS APPROPRIATE)					
a. prepare patient write-ups					
b. prepare for a conference or other presentation					
c. study for exams					
d. personal interest or curiosity about a topic					
5. How did you use Medis? (CIRCLE AS MANY AS APPROPRIATE)					
a. read the abstract on the screen					
b. read the article on the screen					
c. obtained the abstract as output from the printer					
d. obtained the article as output from the printer					
e. had the library reproduce abstracts or articles after identifying material of interest					
f. found the articles myself after identifying material of interest					
g. generated a bibliography for a topic					
How helpful was Medis for each of the following?					
	NOT HELPFUL				VERY HELPFUL
signs or symptoms	1	2	3	4	5
pathophysiology of a disease	1	2	3	4	5
differential diagnosis	1	2	3	4	5
complications	1	2	3	4	5
diagnosis/lab evaluation	1	2	3	4	5
therapy	1	2	3	4	5

Appendix C
MEDIS QUESTIONNAIRE FOR FACULTY

DIRECTIONS: Circle the response which is appropriate for you.

1. I have used Medis.

a. Yes b. No

IF YOU ANSWERED NO, STOP HERE AND RETURN THIS QUESTIONNAIRE. IF YOU ANSWERED YES, PLEASE CONTINUE.

	Strongly Agree	2	3	4	Strongly Disagree
2. I feel capable of using Medis to locate articles in the literature.	1	2	3	4	5
3. Medis has been helpful a tool to me in using the medical literature.	1	2	3	4	5
4. From which location did you prefer to access Medis?					
a. my office					
b. my home					
c. a hospital Medis terminal					
5. Did you ever access Medis through a hospital Medis terminal?					
a. Yes b. No					
6. How many times did you use Medis?					
a. none					
b. 1-3					
c. 4-6					
d. 7-9					
e. 10 or more					
7. For what purposes did you use Medis? (CIRCLE AS MANY AS APPROPRIATE)					
a. patient care					
b. prepare for a teaching assignment					
c. prepare for a conference or other presentation (e.g., grand rounds)					
d. personal interest or curiosity about a topic					
e. as part of research or scholarly writing					
8. How did you use Medis? (CIRCLE AS MANY AS APPROPRIATE)					
a. read the abstract on the screen					
b. read the article on the screen					
c. obtained the abstract as output from the printer					
d. obtained the article as output from the printer					
e. had the library reproduce abstracts or articles after identifying material of interest					
f. found the articles myself after identifying material of interest					
g. generated a bibliography for a topic					