

Preliminary Evaluation of Learning via the AI/LEARN/Rheumatology Interactive Videodisc System

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Abstract:

AI/LEARN/Rheumatology is a level three videodisc system to teach clinical observational skills in three important diseases: rheumatoid arthritis, osteoarthritis, and ankylosing spondylitis. The AI/LEARN software was developed on an independent authoring system called GALE designed for MS-DOS based computers. The purpose of this paper is to present preliminary data about the efficacy of teaching by the use of an interactive videodisc system as evaluated by examinations centered upon disease-oriented learning objectives and by attitude questionnaires.

We tested the efficacy of the AI/LEARN/Rheumatology system using both medical students and residents taking the rheumatology elective. Data collected were on learning, attitudes, and ranking of curricular elements of the rotation. We kept records on the student time and search path through the interactive videodisc system. Control data were collected during 1990, before the AI/LEARN/Rheumatology program was available. Data for the treatment groups were collected during 1991 and 1992, while the trainees used the AI/LEARN/Rheumatology system. The basic difference between the control year and the treatment year curricula was the substitution of AI/LEARN/Rheumatology for three hours of lecture covering the three target diseases.

AI/LEARN/Rheumatology was as effective as traditional methods of instruction as measured by scores on a multiple choice test. Student and resident learning was related to the time spent on the system. Students and residents ranked the AI/LEARN/Rheumatology system as the single most helpful learning tool in their 8 week rheumatology block, ranking it above the examination of patients.

INTRODUCTION

AI/LEARN/Rheumatology [1-5] is an interactive computer videodisc system for teaching clinical observational skills for three important rheumatic diseases: rheumatoid arthritis, osteoarthritis, and ankylosing spondylitis. The content of the teaching material is outlined in Table 1. The unique educational approach is to focus on the key diagnostic features of the diseases and to require the learner to discriminate between the visual concept being taught and other similar visual concepts. Other learning theory features are also incorporated into the modules. The basic approach to the material is guided control of learning with extensive hypertext capabilities to allow for independent exploration of additional information as desired by each learner. This format has been shown to be maximally effective in teaching [6] when compared with learner controlled systems.

The AI/LEARN/Rheumatology software was developed on an independent authoring system called GALE [7] for PC-compatible computers. Some of the software features include (1) videodisc capabilities, both still slides and motion sequences, (2) tracking and recording user responses, (3) large screen fonts to accommodate groups of learners, (4) color coded screens to distinguish between the mainstream programs and other paths in a hypermedia approach, (5) mouse input, and (6) use of WordPerfect macros to aid in creating, editing and debugging content.

The need to develop effective methods to educate large numbers of physicians and other health professionals about rheumatic diseases is of national concern. Approximately 15% of the general population [8,9], are affected with arthritis. With the rise in life expectancy, the proportion of patients having these problems will only increase. Patients with complaints related to the musculoskeletal system account for 5-10% of all visits to the primary care physician [10]. But, the primary care physician often is poorly trained to care for these patients. Since most

people with arthritis have never seen a rheumatologist [11-14], teachers of rheumatology must develop methods of effective education for the wide range of health care professionals who will care for these large numbers of patients. We developed AI/LEARN/Rheumatology to assist in effective education about the rheumatic diseases.

The problems and difficulties with evaluation of computer-assisted instruction has been widely discussed in the literature [6,15,16,20]. Many interactive videodisc systems are being developed but very few of them are adequately assessed before widespread dissemination. The purpose of this paper is to present preliminary data about the efficacy of teaching using an interactive videodisc system as evaluated by an examination centered upon disease-oriented learning objectives and by attitude questionnaires.

Table 1: Content of AI/LEARN/Rheumatology

Disease	Subtopic	Number of Specific Learning Modules
Rheumatoid Arthritis	Overview	3
	Articular Features	2
	Extraarticular Manifestations	1
	Bone Radiography	5
Osteoarthritis	Overview	2
	Articular Features	1
	Bone Radiography	3
Ankylosing Spondylitis	Overview	2
	Bone Radiography	4

METHODS

Forty-six students and residents were in the control year, and 28 students and residents were in the treatment year. The medical students were fourth year students who elected to take the eight week rheumatology block; the residents were from Internal Medicine, Family Medicine, and Physical Medicine and Rehabilitation. We collected data on learning, attitudes, and ranking of curricular components of the rotation. Baseline or control data were

collected during 1990, before the AI/LEARN/Rheumatology program was available. Data were collected from trainees using the AI/LEARN/Rheumatology system during 1991 and 1992.

Curriculum

The control students pursued the traditional curriculum [17], and the treatment students used AI/LEARN/Rheumatology in lieu of lectures on each of the three target diseases: rheumatoid arthritis, osteoarthritis, and ankylosing spondylitis. Other aspects of the block (readings, use of American College of Rheumatology slides, rounds, patient workups, etc.) remained the same for both groups.

The treatment year students were given a floppy disk on the first day of the rotation which was their key disk to AI/LEARN/Rheumatology. They were told that the disk had to be turned in at the end of the rotation to receive a grade. They were not told how much time, if any, to spend on the system. The floppy disk allowed each student to place a bookmark in the middle of a learning module if he/she had to exit precipitously (e.g., was called away), and also had the tracking files.

Data Collected

Student Interviews. One of the study faculty (AJB) interviewed each rheumatology student and resident twice weekly throughout the 4-week rotation, and recorded information on what the student read, what patients the student saw, and what clinics and lectures they attended.

Pretest. Students and residents taking the rheumatology block took an 88-item multiple choice test based on concepts of rheumatology and the block objectives stated in the course syllabus. The first 19 questions were slides of physical findings and the remaining questions were print. The test was originally devised by asking rheumatologists to contribute test items in certain content areas, with a certain percentage of test items covering the three major diseases. The test was previewed on 17 students in 1989. The pretest was revised and finalized by December, 1989 when students were officially admitted to the control group. The tests were administered individually or in small groups the first day of the block.

Posttest. Students and residents took the same test as a posttest 4 weeks later.

Attitude Test. At the end of the rotation, students and residents took an attitude questionnaire with seven Likert items about the clinics, logbooks, slides, and lectures, the number of different diseases seen, whether the objectives

helped, and their ability to work up a patient. They also ranked seven curricular components of the rotation.

Tracking Files. Student responses were recorded on the student floppy disk described above. The disk recorded the student track through the system, the time he/she spent on each screen, and the questions which were answered correctly.

RESULTS

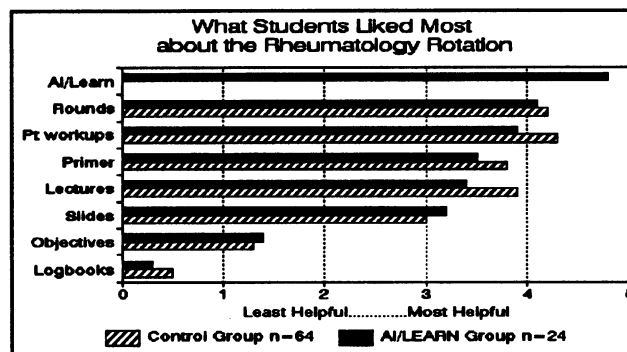
To see whether the treatment group performance on the 88-item multiple choice test differed from the control group, an analysis of covariance was run on the posttest score with the pretest being the covariate. Least squares means for the control and treatment groups were 56.5 (s.d. .77) and 58.3 (s.d. .99) respectively. An F-ratio between the full and restricted models was 2.04 (1,71) which is not significant ($p=0.16$). Analysis of those 66 specific test items covered by AI/LEARN/Rheumatology showed no significant differences between the control and the treatment students' learning.

Analysis of covariance of the 88-item posttest scores of the treatment students and residents adjusted for the pretest values showed significant improvement when length of time (as measured by tracking files) was added to the analysis, $F = 9.44 (1,20) p < .01$. This was based on $n=23$ rather than the $n=28$ treatment group because two students spent no time on the system and the tracking files of three students had some problems. This indicates a significant increase in learning associated with increased time spent on the AI/LEARN/Rheumatology videodisc system. Total time on the system ranged from 1.02 hours to 10.1 hours [mean time = 3.80 hrs, s.d. = 2.34 hrs]. The correlation between posttest score and time spent on AI/Learn was .45, $p < .03$.

Of the seven Likert items on the attitude questionnaire, there were no significant differences between the two groups except for the question, "we had enough different diseases". The control group mean was 3.9 (s.d. 0.8) and the treatment group mean was 4.3 (s.d. 0.7) which was significant by a Wilcoxon test ($\chi^2= 4.50, p=.04$). This finding suggests that the treatment group felt somewhat more positive that they had seen patients with enough different diseases. A review of the number of consults seen during the control and treatment years showed that there were significantly fewer consults per month during the treatment year than the control year.

For the seven ranking items on the attitude questionnaire common to both groups, there were no significant differences between control and treatment groups, by Wilcoxon tests. However, students in the treatment group

ranked the AI/LEARN/Rheumatology experience as being more helpful than any of the other aspects of the block (rounds, patient workup, lectures, slides, etc) (Figure 1).



DISCUSSION

This preliminary analysis of the first 28 students and residents in the treatment group demonstrates that AI/LEARN/Rheumatology is as effective in teaching as lectures by medical professionals, and has the advantage of being available for independent learning. The faculty were not blind to the experiment and provided an optimal educational experience during the period of this study. Nevertheless, the AI/LEARN/Rheumatology system proved to be as effective as the faculty lectures in promoting mastery of specific objectives. Of particular note, the time spent on the videodisc system is an important component to the learning which occurred. Those students and residents who spent more time learned more. We are investigating these data further to determine the magnitude and details of this time component.

Medical students and residents enjoyed using AI/LEARN/Rheumatology and ranked it as the most helpful learning tool in the rheumatology rotation (even above patient workups). The high ranking received by AI/LEARN/Rheumatology may be a reflection of the uniqueness or "newness" of the system. Nevertheless, AI/LEARN/Rheumatology appears to be a very useful part of the trainees experience.

The trainee's experience with AI/LEARN/Rheumatology may have played a role in the difference noted in the trainees' subjective sense that they saw more patients during the treatment year compared to the control year, though in fact they saw fewer. Many of the trainees spent a significant amount of time on AI/LEARN/Rheumatology early in the rotation. The trainees saw many physical findings while using AI/LEARN/Rheumatology. This may have helped them key on more detailed physical findings on the patients they did see, making it appear that they saw plenty of patients.

The results of this study relate in important ways to other published results. Many studies have determined that multimedia and interactive videodisc instructional materials can be as effective as other more traditional formats [6,15,22]. Studies using interactive video as a supplement to existing instruction showed significantly more learning than those studies which substituted traditional instruction with the computer based materials [6]. Our studies replaced three hours of lecture with an equivalent amount of information available in a self-study format.

Several additional avenues of evaluation of interactive videodisc materials have shown positive results as reported in the literature. These include an analysis of time spent on a specific learning task which indicates that in some selected areas that self-directed learning on an interactive videodisc system is more efficient than in a lecture format [18,23]. Studies have also shown that there is increased retention of information [6] and improvement in the ability to act upon the learned material in real-world settings [6,24]. Studies on student search paths [21,25] through interactive computer systems have demonstrated that there is a difference between those students who understand the material and those students who are foundering. Our preliminary data have not yet been analyzed to determine these important and interesting concepts.

CONCLUSIONS

This preliminary analysis of learning effectiveness demonstrated that the AI/LEARN/Rheumatology interactive videodisc system was as effective as traditional methods of instruction. Student and resident learning was related to the amount of time spent on the system. Students and residents ranked the AI/LEARN/Rheumatology system as the single most helpful learning tool in their rheumatology rotation, even ranking it above the examination of patients.

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