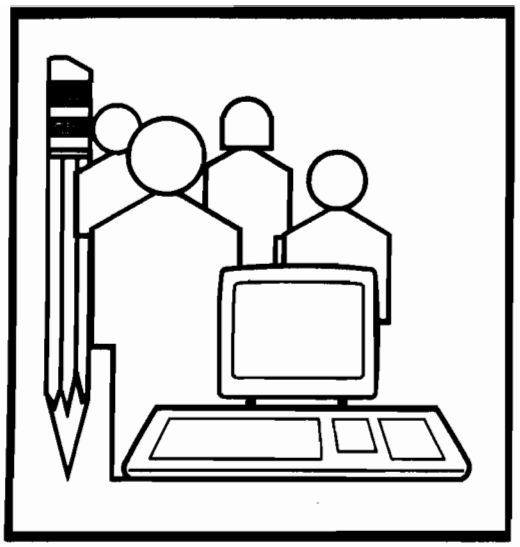

TECHNICAL REPORT

CORPORATE EXPERIENCE IN EVALUATING INTERACTIVE VIDEO INFORMATION SYSTEM COURSES

Technical Report No. 22

February 1984

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CORPORATE EXPERIENCE IN EVALUATING INTERACTIVE VIDEO INFORMATION SYSTEM COURSES

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ABSTRACT

Digital Equipment Corporation has developed an interactive video product called the Interactive Video Information System. This system, known as IVIS, has been used to teach Digital's Field Service engineers how to operate and repair Company products. When IVIS was introduced for this purpose, evaluation studies were conducted to answer the following questions:

1. Would Field Service engineers take less time to complete IVIS courses than to complete traditional Self-Paced Instruction courses?

2. Would Field Service engineers who complete IVIS courses be able to service products as effectively as engineers who complete traditional Self-Paced Instruction courses?

3. Would Field Service engineers accept IVIS as a training delivery system?

4. Would Field Service engineers perceive IVIS courses as more stimulating and motivating than traditional courses?

The results of the evaluation studies, which are presented in this paper, indicate that the answer to all four questions is yes. As a result of these evaluation findings, Digital is planning to use IVIS for 75% of its Field Service training.

This paper was presented at a conference on Interactive Instruction Delivery in Education, Training, and Job Performance, sponsored by the Society for Applied Learning Technology, in Orlando, Florida, on February 16, 1984.

INTRODUCTION

Digital Equipment Corporation is the world's second largest manufacturer of computer hardware, software, and related services. Its Field Service organization has over 15,000 engineers worldwide. These individuals are responsible for diagnosing problems and maintaining Digital's computer products. This work force alone generates over $1 billion per year for Digital.

Keeping a decentralized work force of this magnitude trained on current products and maintenance techniques is a major undertaking. Within Digital's Educational Services Department there is an entire group devoted to training these engineers. Historically, this training has been delivered in several specially equipped training centers using such traditional methods as lecture/lab courses and self-paced instruction (SPI) courses which utilize books, filmstrips, linear videotapes, and lab exercises.

These methods have proven inadequate for several reasons. First, the cost of the training is becoming prohibitive. Second, the time away from their offices adversely impacts the productivity of engineers. Third, these methods often do not stimulate or motivate students. And finally, students have limited opportunity to review materials upon returning to their offices.

In response to these problems, Digital developed the Interactive Video Information System known as IVIS. IVIS is a high quality interactive video system that combines Digital's Professional 350 computer with a laser optical reflective videodisc player. On a high resolution color monitor, IVIS can display computer-generated text and graphics over sound, motion, and still frame video images. IVIS is designed to provide self-paced interactive learning with video simulation that enables students to observe real-life situations and solve problems on-line. (For a fuller description of IVIS, see Heines, Olsen, and Bowker, 1984.)

When Educational Services introduced IVIS into the Field Service training environment in November 1982, it had two primary instructional goals:

1. To provide training which is more effective and stimulating than such traditional methods as lecture/lab and self-paced instruction using videotapes and/or workbooks.

2. To provide training which would take less time to complete than traditional methods.

During the past 15 months, Digital's Educational Services' organization has conducted evaluation studies to determine whether IVIS courses can meet these goals. This paper describes the procedures and the results of these evaluation efforts.

EVALUATION QUESTIONS

Since November 1982, evaluation studies of the first IVIS courses have been conducted by Digital's Educational Services Department. The courses evaluated were designed to train Digital's Field Service engineers in the operation, installation, and repair of three company products. The first course was for the LA 100 line printer, the second for the Professional 350 personal computer, and the third for the VAX 11/730 minicomputer.

The evaluation studies focused on the following questions:

1. Would Field Service engineers take less time to complete IVIS courses than traditional self-Paced Instruction courses?

2. Would Field Service engineers who complete IVIS courses be able to service products as effectively as engineers who complete traditional SPI courses?

3. Would Field Service engineers accept IVIS as a training delivery system even though it has simulated lab experiences instead of the hands-on lab exercises offered in traditional lecture/lab and self-paced courses?

4. Would Field Service engineers perceive IVIS courses as more stimulating and motivating than traditional courses (such problems as inattentiveness and skipping of materials have been frequently observed in the traditional delivery methods)?

COURSE COMPLETION TIME AND PRODUCT SERVICING

Study Procedures

To answer the first two study questions, which focused on course completion time and effectiveness of product servicing, Field Service engineers who completed an IVIS course were compared with those who completed a traditional SPI course. These comparisons were made by randomly assigning Field Service engineers qualified to receive training on the equipment to either the IVIS or the SPI version of a course. The subjects were selected from Digital's New England Field Service offices. All subjects met the course prerequisites and assignments were made so that the students in each group had comparable technical experience. In addition, assignments were made so that there was a balanced distribution of male and female engineers in each group.

The content of the IVIS and SPI versions of each course was essentially the same. Students were told to complete a course in the same way they would if they were not part of this study. Table 1 indicates the sample sizes for the course completion time and product servicing study.

Study Results

Original estimates were that students would take 20% to 50% less time to complete an IVIS course than a comparable SPI version. The data on course completion time is summarized in Table 2. These data indicates that the average time students needed to complete the IVIS courses was 23.1% to 46.5% less than the time students needed to complete the SPI version. Using t-tests, these differences were significant at the .001 level for the LA 100 and VAX 11/730 courses and at the .05 level for the PRO 350 course.

After completing the IVIS or SPI course, the Field Service engineers were presented with one or more "fault isolation" problems. Each problem included a script which gave an indication of the type of difficulties a piece of hardware (the LA 100, PRO 350, or VAX 11/730) was having. After reading the script, students were timed until they reached a predefined solution to the problem or they exceeded a selected default time. The IVIS students were given the same problems as the SPI students. Their exposure to the hardware was through simulations presented in the course. The SPI students, however, had hands-on experience with the products through lab exercises which were part of their course.

Table 1

SAMPLE SIZE FOR COURSE COMPLETION
AND PRODUCT SERVICING STUDY

(after Spencer, 1983)

Course	Sample Size	
	IVIS	SPI
LA 100	13	12
PRO 350	25	16
VAX 11/730	13	10

The goal was that there would be no significant differences between the time that the IVIS students needed to successfully solve the fault isolation problems and the time that the SPI students needed to solve the same problem. The data on completion of the fault isolation problems is summarized in Table 3. Based on t-test analysis, there were no significant differences between the times it took IVIS and SPI students to successfully solve the fault isolation problems presented to them.

Summary

On the basis of the results which were displayed in Tables 2 and 3, Digital has concluded that IVIS courses could be completed in less time than comparable SPI courses and could effectively prepare technicians to service products. Data on actual repair performance in the field will be collected on both IVIS and SPI students in order to have additional information on which to judge the effectiveness of IVIS courses.

STUDENT REACTIONS TO IVIS COURSES

Study Procedures

To answer the last two study questions, which focused on Field Service engineers' reactions to IVIS, the LA 1ØØ, PRO 35Ø, and VAX 11/73Ø courses were sent to several of Digital's Field

Table 2

COMPARISON OF RESULTS OF COURSE COMPLETION TIME

(after Spencer, 1983)

Course	Average Time to Complete (min)		Percent Difference	Signif. Level
	SPI	IVIS		
LA 1ØØ	288	154	- 46.5	.ØØ1
PRO 35Ø	4ØØ	3Ø8	- 23.1	.Ø5
VAX 11/73Ø	1668	1Ø78	- 35.4	.ØØ1

Table 3

COMPARISON OF TIME TO COMPLETE FAULT ISOLATION PROBLEM

(after Spencer, 1983)

Course/Fault*	Average Time to Complete (min)		Percent Difference	Signif. Level
	SPI	IVIS		
PRO 350 Fault A	9.4	6.4	- 32	NSD**
PRO 350 Fault B	11.1	9.7	- 13	NSD
PRO 350 Fault C	11.1	19.3	+ 42	NSD
PRO 350 Fault D	12.6	10.5	- 17	NSD
VAX 11/730 Fault A	10.7	11.2	+ 4	NSD
VAX 11/730 Fault B	18.3	21.9	+ 16	NSD

* The sample sizes for the LA 100 course were not large enough to be included in this analysis.

** No significant difference.

Service Training Centers in the United States, Canada, Europe, and Australia. Each of these sites received the hardware and software needed to administer IVIS courses to Field Service engineers in their areas. These sites were:

- Atlanta, Georgia
- Bedford, Massachusetts
- Los Angeles, California
- Phoenix, Arizona
- Princeton, New Jersey
- Rolling Meadows, Illinois
- Calgary, Canada
- Reading, England
- Sydney, Australia

Field Service engineers who worked in offices near these training centers and who needed to learn how to service these products were scheduled to take one or more of the three IVIS courses.

After taking an IVIS course, students were asked to complete an on-line Student Opinion Form (SOF) designed by the Educational Services Quality Assurance Group. This opinion form was designed to obtain feedback from Field Service engineers on whether they accepted IVIS as a training delivery system and whether they thought IVIS courses were stimulating and motivating. The questionnaire consisted of 22 statements on which students expressed their opinions by selecting a response to a 5-point Likert scale ranging from Strongly Agree to Strongly Disagree. The SOF covered topics in course design and content, course delivery and media, course facility and administration, and the IVIS training experience. Students were also asked for their open-ended comments on three questions:

1. What did you find most useful in this training experience?

2. What did you find least useful in this training experience?

3. What other comments would you like to offer?

Study Results

The data from the students who completed the 22-item Student Opinion Form are summarized in Table 4. These data, which are comparable to student ratings in traditional courses, indicate that Field Service engineers have a very positive opinion of IVIS as a training delivery system. On the LA 1ØØ and PRO 35Ø courses, average student ratings in all dimensions of the course were in the Strongly Agree to Agree range. However, ratings on the VAX 11/73Ø course were not as high. The lower ratings in this course can be primarily attributed to hardware and software

operating problems experienced by the students. For example, the average response to the statement "The course software operated without difficulties" was 2.95, the lowest rating of any item over all three courses. The VAX 11/730 ratings indicate the need to thoroughly check and debug the software that operates an IVIS course before the course is made available to students. Such software checks have now been built into the process Digital uses for developing IVIS courses.

The open-ended comments from students corroborated the ratings on the Student Opinion Form. Samples of some of the student comments on each course follow:

1. I felt that training on the IVIS is a great tool in the learning process. You should have more courses designed like this one.

2. It was quite a bit of fun and kept me interested. Far better than all other self-paced courses I have done to date.

Table 4

STUDENT OPINION RESULTS

Course *	Average Student Opinions **				
	Course Overall	Design & Content	Delivery & Media	Facility & Admin.	IVIS Experience
LA100	4.40	4.40	4.45	4.36	4.36
PRO350	4.47	4.52	4.46	4.43	4.47
VAX730	4.00	4.03	4.06	3.91	3.94

* Data on the LA 100 course was obtained from 88 students, data on the PRO 350 course was obtained from 59 students, and data on the VAX 11/730 course was obtained from 52 students.

** On the rating scale that was used, 5 = Strongly Agree, 4 = Agree, 3 = Neither Agree nor Disagree, 2 = Disagree, and 1 = Strongly Disagree. A rating of 5 indicates that students were very positive about the course, and a rating of 1 indicates that students were very negative about the course.

3. There was no hands-on training. I feel that in order to properly train a field representative, he needs to know how to run the software as well as get his hands on the equipment.

4. Very professional way to be trained in new products. Actual views of the hardware help very much in understanding the equipment. A very nice experience.

5. This video, audio and color graphics is a fantastic learning tool. I was completely motivated in completing this course. I think DEC has taken a giant step in A/V courses compared to previous A/V equipment. Congratulations.

6. Fix your software!!!

7. Overall, I think it is very good. It keeps your attention well and is a lot more interesting than reading from books or listening to a lecture.

Summary

On the basis of these ratings and comments, Digital has concluded that IVIS is an acceptable delivery system for Field Service engineers and that IVIS can stimulate and motivate learning. While some students had reservations about the lack of hands-on experience with equipment, overall they indicated IVIS would effectively prepare them to service products. Because of the comments on hands-on training, some Field Service IVIS courses in the future will include optional lab exercises. Students' comments also indicated the importance of thorough software checks before courses are shipped to training sites.

CONCLUSIONS

In developing IVIS, the Interactive Video Information System, Digital Equipment Corporation's Educational Services Department has paid much attention to evaluating the quality of courses delivered on this new instructional technology. The initial IVIS courses for use in training internal Field Service engineers have been thoroughly evaluated. The results indicate the following:

1. Students need significantly less time to complete an IVIS course than a comparable SPI course.

2. There is no significant difference in the time needed to service a product between Field Service engineers who complete an IVIS course and those who complete a tradi-

tional SPI course.

3. Digital's Field Service engineers readily accept IVIS as an educational delivery system.

4. IVIS courses are perceived by Field Service engineers as more stimulating and motivating than traditional lecture/lab and SPI courses.

On the basis of these findings, Digital's Field Service training organization is planning to use IVIS as its primary educational delivery system. By 1987, 75% of all Field Service training will be offered through IVIS. At that time, there will be 515 localized learning centers, known as Education Information Centers (EIC's), in operation throughout the world. In these EIC's, field service engineers, as well as software service and sales personnel, will be able to select from numerous IVIS courses.

The benefits which Field Service plans to receive as a result of IVIS include improved quality of training, increased standardization of training, convenience of retraining and review training, and significantly decreased training costs. Training costs will be reduced because of decreased time to train, reduced travel and per diem expenses, and reduced need for lab equipment.

ACKNOWLEDGMENTS

I would like to acknowledge the following people in the Educational Services Department who assisted me in the preparation of this paper: Jim Geary, Hossein Hosseini, Rick Lent, Carol Ann Moore, John O'Rourke, John Spencer, Howard Spielman, Jeannine Volkert, and Steven Zammit.

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