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ABSTRACT

Operational analysis is defined as a part of formative evaluation, taking place while a course is in progress. Student-perceived problems, as reflected by student-initiated reports, are the source of data for this phase of formative evaluation. The self-reporting techniques can reveal individual differences in student/learning-environment interactions which are not obtainable (or more difficult to obtain) by other means. The individual student's perceptions can then be used to improve the instructional program. This technique (report) is described, and some applications of the data for administrative purposes are discussed. The administrative staffing for the Project IMPACT operational computer-administered instruction course is described. (Author)

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Student-Initiated Reports: Operational Analysis in the Evaluation of CAI Curricula

Michael J. Hillelsohn

Based upon a talk at the
Association for the Development of
Computer-Based Instructional Systems
(ADCIS), Washington, D.C. January 29 - February 1, 1974

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Prefatory Note

This paper is based on an informal talk given by Michael J. Hillelsohn of HumRRO Eastern Division, Alexandria, Virginia. The presentation was made at the meetings of the Association for the Development of Computer-Based Instructional Systems (ADCIS) January 29 through February 1, 1974, in Washington, D.C. Assistance in the preparation of the paper was provided by Dr. Robert J. Seidel and Richard Rosenblatt, also of the Eastern Division.

HumRRO's work in computer-administered instruction for the Department of the Army has been performed under Project IMPACT, Prototypes of Computerized Training for Army Personnel, and is currently being performed under Work Unit CATALIST, Computer Applications to Training for Advanced Learning in Integrated Systems Technology.

STUDENT-INITIATED REPORTS: OPERATIONAL ANALYSIS IN THE EVALUATION OF CAI CURRICULA

Michael J. Hillelsohn

Rationale

Operational analysis, a subset of formative evaluation, takes place while a course is in progress. Student-perceived problems, as reflected by student-initiated reports, are the source of data for this phase of formative evaluation. As we use the term here, evaluation provides data to decision makers (Scriven, 1967). The difference between formative and summative evaluation lies in the nature of the decision and who makes it. Formative evaluation output is used mainly by course developers and administrators, while summative data are the basis for potential consumer decisions (Scriven, 1967; Stake, 1969; Cunningham, 1971; Mehlinger and Patrick, 1970; Johnson, 1970). Formative evaluation, then, is a continuous cybernetic process that begins after there is an assurance that a student can get from the beginning of the instructional program to the end, and it may or may not end when the summative evaluation is initiated.

Using the student's perceptions and actions to describe the instructional program as it actually occurred, which may or may not be congruent with the developer's prediction, is a technique that has been proposed before (Fitzpatrick, 1970; Tracey, 1968; Yeager and Lindvall, 1968; Mehlinger and Patrick, 1970). Some of the techniques that have been tried include having the evaluator (author, developer, etc.) be with the student to observe him as he goes through the instruction, employing third-party observations, and debriefing. The techniques that have evolved, however, have not satisfied all the criteria of timeliness, cost-effectiveness, accuracy, and relevance to the decision maker's needs. The techniques and tools for operational analysis herein described have been successfully employed by Project IMPACT in a tutorial Computer-Administered Instruction (CAI) environment and meet these criteria.

The placement of formative evaluation between the debugging (verification) of the instructional logic and the summative evaluation is shown in Figure 1. The design and development of the management (and evaluation) tools take place after the characteristics of the instruction are specified, but before formative evaluation begins. The update controller that receives its input from the formative evaluation effort is defined as a revision algorithm whose function is to indicate, to the course developers, where in the design and/or development of the instruction he has to return to make a change. The operationalized course extends from module (topic) 1 to module N. Once students are taking the course, the formative evaluation process officially begins.

The shaded blocks in Figure 1 represent our version of the usual analyses for formative evaluation. The last decision diamond on the right is superfluous if the module N and the course criterion tasks are the same. The end-of-module analysis includes item-by-item and summary data on the student/instruction interaction. Test scores, latencies, question solutions, comments, expectancy operators, error rates, and anything else worthy of measurement are examined during this analysis. The data are massaged and, if deficiencies surface in the instruction, are used to effect systematic improvement in the overall instructional program. When the module functions as prescribed, the data are stored so that if a later module, for which module 1 is a

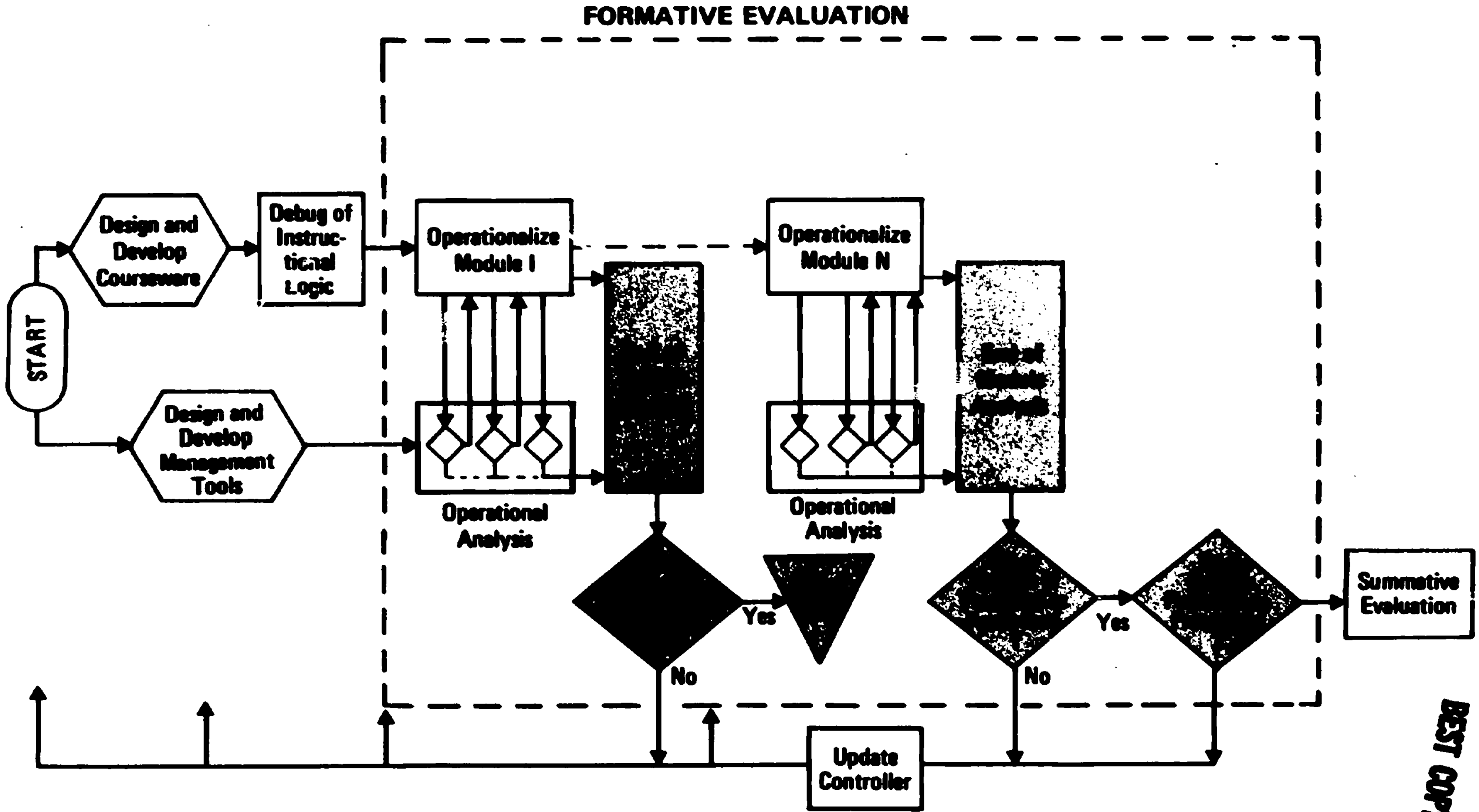

Figure 1. **Placement of Formative Evaluation in the Curriculum Development Process**

prerequisite, malfunctions, these data will be re-examined. Also, data gathered in formative evaluation may be useful later to a decision maker performing a summative evaluation.

However, if the role of evaluation is to provide data for decision making leading to the improvement of the instructional environment (Scriven, 1967; Lindvall and Cox, 1969; Jones, 1971), then the end-of-module analysis does *not* provide enough information in individualized instruction. To be complete, evaluation must include more than the usual quantitative measurement (Jones, 1971; Yeager and Lindvall, 1968) implied by the performance data gathered at the end of modules. The qualitative nonnumeric measurement via student-initiated reports made during display-by-display interaction is a potential source of valuable formative information.

One reason for inhibition on the part of developers to making curricular changes is that, as Larkins and Shaver (1968) found, standard evaluation designs often do not provide adequate information to justify and then determine curricular modifications. This is especially applicable in nontraditional types of instruction. Minor modifications are often required to meet the needs of subpopulations within a student group and assessment of these needs is often best made by members of the subpopulation.

The goal of the instructional situation determines the relevant measures for evaluation of the instruction (Flanagan and Jung, 1970). If the goal is individualized instruction, then the individual is an important source of data and should not be ignored. In order for a decision maker to reach conclusions that are appropriate in this situation, he should have feedback from the students who undergo the instruction. Therefore another type of analysis should take place during formative evaluation and, since it is concurrent in time with the operationalized course, it is called operational analysis.

During operational analysis, student-perceived problems are entered into the data base as they occur and decisions are made whether to take action immediately or to use the data in the end-of-module analysis. As stated by Seidel (1971, p. 5), the premise behind this approach is that "The organism [student] is an active organizing force in its interaction with its environment. . ."[1] Through our self-reporting or student-initiated techniques, we are able to capitalize on these active, organizing capabilities. Individual differences in student/environment interactions can be revealed and the individual student's perceptions can be used to improve the instructional program.

Staffing and Physical Characteristics of Learning Area

Before going into the techniques themselves, it is desirable to describe the personnel and peripheral hardware configuration in the Project IMPACT learning environment. Key personnel during course operation are shown in Figure 2, with course administration personnel in the section enclosed by dotted lines.

A brief description of the functions of each member of the latter group is in order. The Director for Daily Operations is responsible for the efficient day-to-day "running" of the course. He serves as liaison to the directors for other components of the total system. It is his responsibility to ensure that required system (any component) changes are accomplished in such a manner that student progress is minimally affected. In effect, he is a traffic manager for problem solutions and computer utilization while students are on-line. His duties also include supervision of the proctoring staff. The Operations Monitor (OM) is responsible for the smooth running of a particular student period/shift (Project IMPACT had three daily three-hour shifts) and supervising the proctors on that

[1] As interpreted from Heinz von Foerster, "Molecular Ethology: An Immodest Proposal for Semantic Clarification," *Molecular Mechanisms in Memory and Learning*, G. Ungar (ed.), Plenum Press, New York, 1970, p. 234.

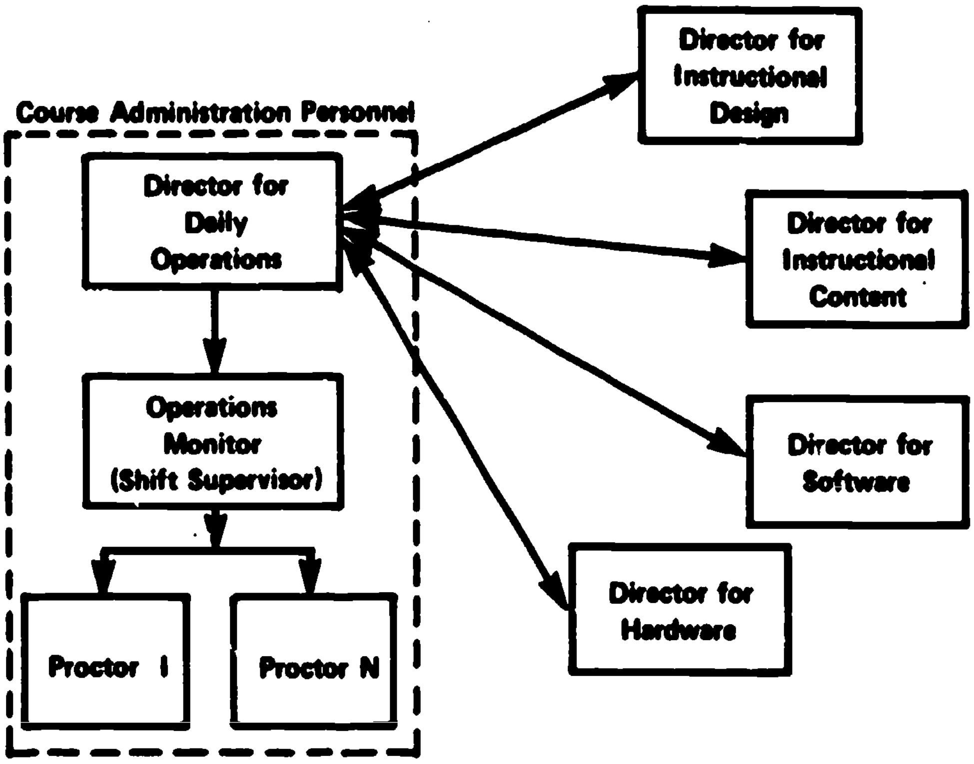

Figure 2. **Key Personnel During Course Operation**

shift. He serves as a resource for the proctors and is the only person assigned to the shift who can give the student subject-matter relevant information. Because of these functions, it is desirable that the OM take the course he is "OMing" for, and also serve some time as a proctor. These experiences give the OM first-hand knowledge of the kinds of problems encountered on "both sides of the fence."

The proctor's function is purely procedural and the students are informed of this. He is responsible for ensuring that the student has all required materials, correcting minor hardware difficulties (such as auxiliary visual display does not align properly with primary display), answering system-generated proctor calls, diagnosing the student's problem and, if it is subject-matter specific, referring the problem to the OM. The continuous interaction of the student with the instruction is shown in Figure 3. It is included to show that after the proctor/student interaction occurs the student returns to his interaction with the instruction. It is *not* the proctor's function to intercede for the student, but rather to enable the student to continue on his own.

Because of the large amount of proctor/student interaction that may occur, and because the students perceive the proctor as a course and system expert, a prospective proctor is required to go through the course of instruction in the same manner as any regular student. It should be noted that no mention was made of a requirement that the proctors (or OMs) be subject-matter experts. They must be course experts (mechanics and texts), but at Project IMPACT the courseware subsystem has enough off-line documentation (see Willis, *et. al.*, 1972; Hillelsohn, 1974; and various support documents, internal proctor guides, memos, etc.) that subject-matter expertise is not requisite for proctors.

Proctors must be knowledgeable about the peripheral hardware used in the learning environment. The layout of the Project IMPACT learning environment is unique in that the student carrels are designed so that the student is, in effect, in his own private room, with all the necessary learning materials at his disposal. The learning area is diagrammed

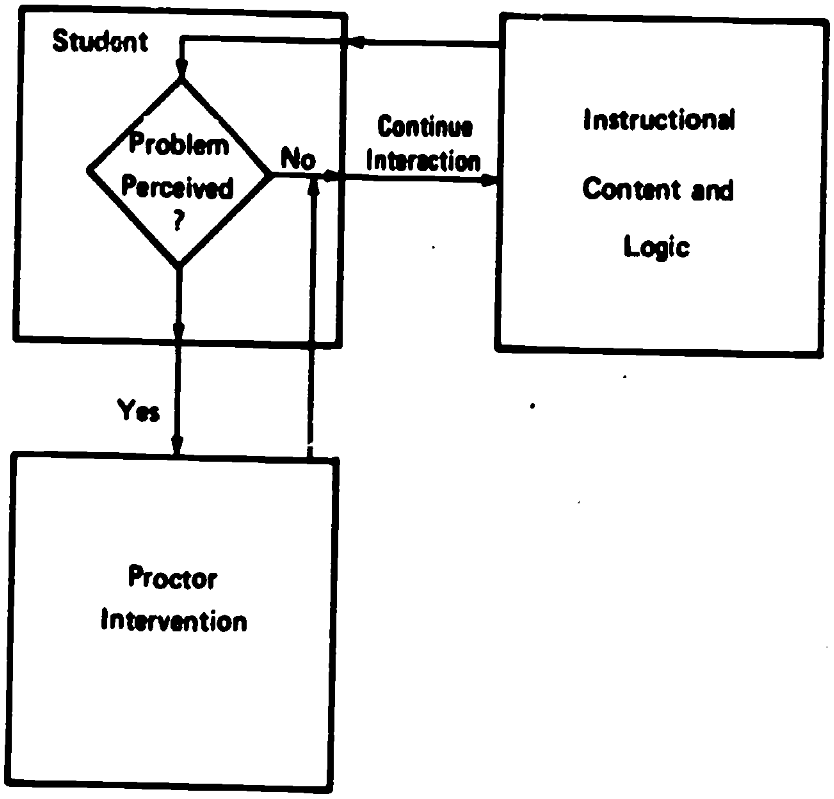

Figure 3. **Proctor's Position in the Student/Instruction Interaction**

in Figure 4, with the major hardware components identified. Proctors must be familiar enough with the cathode ray tube (CRT) to solve such problems as locked keyboards, scrambled screens, flicker, and so forth, and to recognize the symptoms of problems that require a factory service mechanic to fix. With the auxiliary visual device, problems that should be remedied by the proctor include realignment of visual images on the display screen, reloading of film, and ensuring proper coordination of primary and auxiliary display. The student initiates proctor intervention for the solution of these and other problems by pressing the proctor call button, at which time a buzzer sounds in the proctor room and a light, designating the carrel from which the request originated, is illuminated on the call box. The proctor then goes to the student, diagnoses the student's problem, and effects a solution.

Data on student reaction to proctors and how their functions were performed were gathered in the questionnaire that all students filled out upon course completion. The results show that 76% of the students perceived the proctors as friendly, 80% perceived them as knowledgeable, 77% as helpful, 97% as maintaining a proper degree of formality, and 77% as able to supply information as required. In short, non-subject matter experts can be successfully employed to interact with students during instruction.

The Report

In a tutorial CAI application it is crucial that the course administrator, course evaluator, and others be able to determine what occurred during the proctor-student interaction: Has the student come across a problem that will affect other students when they reach that point in the course? Has the student asked the proctor for information that has already been presented or is going to be presented? Has the proctor given the student too much subject-matter relevant support? Or has the proctor given him

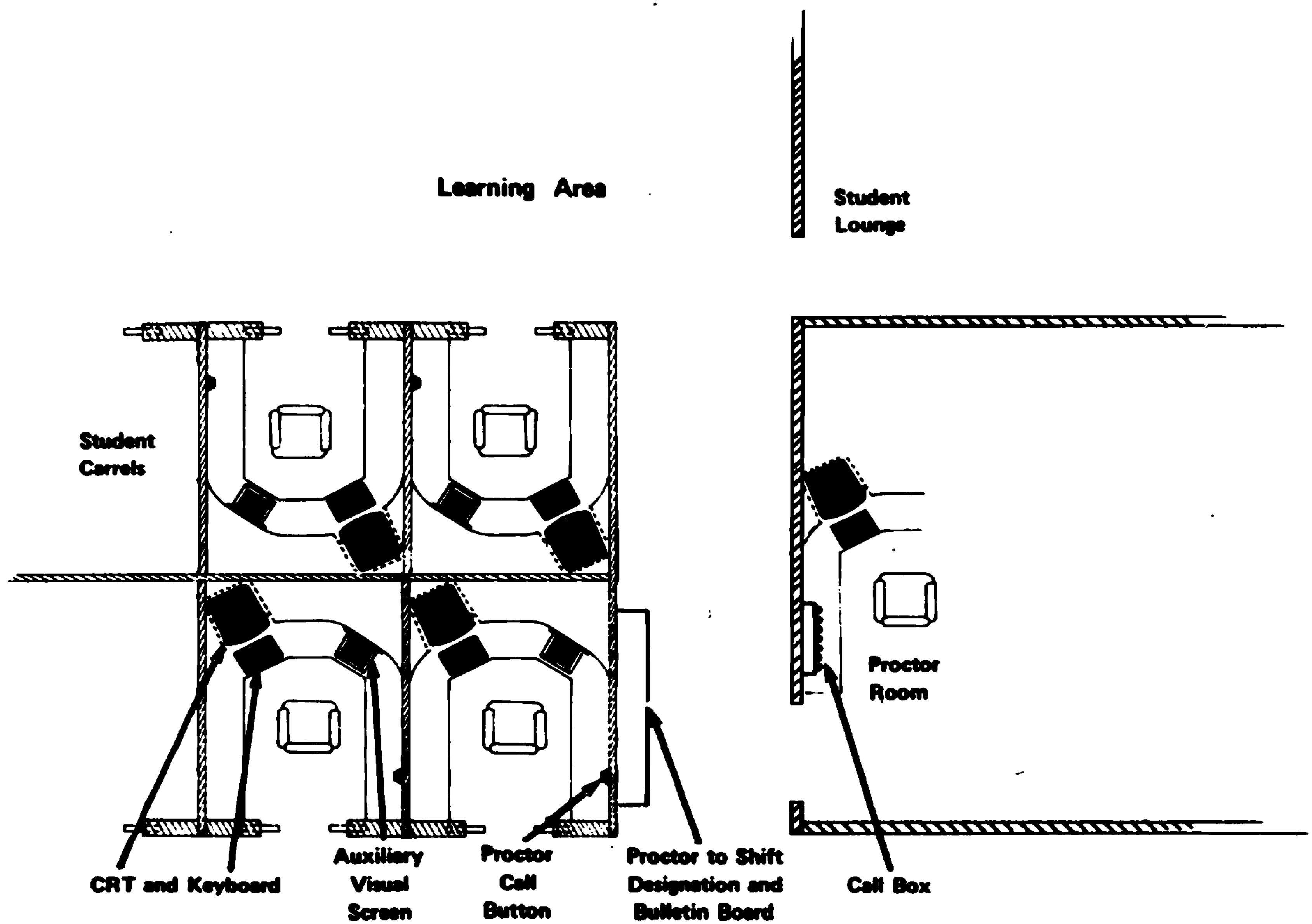

Figure 4. **Project IMPACT Learning Environment**

misleading information? The possibilities are endless, and if each interaction is not documented, the end-of-module evaluation of both course and student performance is confounded by an unknown variable.

Therefore, at Project IMPACT, a Trouble Report (TR) was designed and developed in which the proctor can document his interaction with the student. After an off-line evaluation period, the TR was put on-line in its present form (shown in Figure 5). The proctor uses the CRT in the proctor room to input the data, and is "signed-on" to an administrative course (VOYEUR, Appendix A) as a student, thereby not increasing system overhead. The records generated are compatible with all other student records, but are identified as proctor recordings by the unique course name. The display was designed by both an instructional and an applications programmer so that the data would be recorded in such a form as to allow easy manipulation and analysis.

The data are first recorded in the same format and manner as any student record (see Figure 6), but bytes 205 through 304, instead of containing the student response, contain the information that the proctor is reporting.[1] What is this information? When the proctor leaves the student and reenters the proctor room he goes to the CRT and calls up the TR element. He keys in the CWIP, or location in the course where the interaction occurred, then the student number, cubicle (carrel) number, his initials, the initials of the OM for that shift, and then the alphanumeric code defining the trouble that prompted the student call. The student group identification number, date, time, and TR number (ID) are filled in by the software system.

There are four major categories of troubles shown in Figure 5. Those listed under the heading "IP" relate to student-perceived problems with the instructional text; those under "CW" relate to problems in the instructional logic and related software; "HRDWRE" problem entries recorded hardware failures that are more often related to the cubicle wherein they occurred than to the student who initiated the call; problems listed under "MISC." are mainly for record keeping on problems which are usually fixed, if fixing is required, by the proctor during the proctor call. Trouble "50" allows the proctor to define the reason for the proctor call if it does not fit into one of the predefined categories. The specific problems listed on the Trouble Report are, in many cases, unique to the Project IMPACT hardware/software subsystem (documented in Underhill and Stelzer, 1972; Garneau, *et al.*, 1972; Shuford and Stelzer, 1972) and would be replaced in other applications with relevant entries. The second page of the TR (shown in Figure 7) allows the proctor to explain and describe the interaction he just had with the student and, if relevant, provide suggestions for action to eliminate the reason for the proctor call. The information on the top of the page is duplicated, by the system, from page 1 (Figure 5) of the TR onto its appropriate position on page 2 (Figure 7) and the proctor need fill in only as many lines of explanation as are required to fully explain what occurred during, and what caused, the interaction.

As stated earlier, these recordings are in the same format as any student record, but bytes 205 through 304 contain the encoded information that the proctor entered into the system. The record layout for this segment of the recording for page 1 of the TR is shown in Figure 8. For recordings of page 2, these bytes were filled with exactly what the proctor says in his explanation. Byte 304, the update code, is not entered by the proctor, but is most important to the course administrator.

[1] For detailed explanation of the record entries see Willis and Stelzer, 1972.

CWIP...   STUDENT NO. ...   CUBICLE..   PROC. ...   OM ...   ID.   1008   DATE 9 JAN 1973   TR 14
TIME: 18:57

TROUBLE ..   XX IN QUIZ

IP	CW	HRDWRE	MISC
A1-TYPO CRT	G1-RESPONSE ANAL.	M1-LOST CUE COUNT	S1-LOCKED KBD
A2-TYPO P-SCOPE	G2-CURSOR POS. NG	M2- P-SCOPE NG	S2- P-S OFF CENTER
A3-TYPO MANUAL	G3-CRT SCRAMBLED	M3-SYSTEM CRASH	S3-MULT. CURSORS
A4-CRT TEST NG	G4- P-SCOPE CUE NG	M4-LIGHT PEN NG	S4-MISSING MATLS
A5-PSCOPE TEST NG	G5-WRONG BRANCH	M5-CRT NG	S5-IDM PROBLEM
A6-MANUAL TEST NG	G6-CRT BLANKED	M6-LINE TROUBLE	S6-S ERROR
A7-DIRECTIONS UNCLR	G7-WRONG FDBK	M7-BULB BURN-OUT	S7-CMI CUB BUSY
A8-SUBJ MATTER ?	G8-WRONG POINTS	M8-VIEWLEX NG	S8-IP INTERNAL
A9-XX IN P SECTION	G9-TP I/O ERROR		
B1-OPTION PROB.	H1-EXCESS PROC.		
B2-GLOSSARY PROB			
B3-PROGRAM ?			

50-OTHER..

Figure 5. **On-line Trouble Report, Page 1**

Byte	Contents
1-6	Course Name
7-8	Course Segment Number
9-30	Student Name
31-33	Registration Date
34	File ID for Course Segment Zero
35-36	Pointer to Course Segment Zero
37-38	Prior Sign-on Date (Julian)
39-48	Current Label—problem-sequence number
49	User Number Prefix (S=Student)
50-58	Student Number
59-61	User Group ID
62	Last executed major operation code
63	UN Counter 1 (count of UN Statements)
64	UN Counter 2 (count of unanticipated responses)
65-67	Current Date (DDY, DD=Julian Day)
68	Status of Operation (i.e., 01=Sign-on status)
69-70	Time of Sign-on (in minutes)
71-76	Label before last problem op code (location)
77-78	Last QU number
79-80	Total time on course (in minutes)
81-116	Return register area for registers 0-5
117-178	Area for 31, 2-byte counters
179-182	Area for course switches 0-31
183-186	Area for course parameters flags 0-31
187-188	Recording time (in minutes)
189-204	Left word extension of Buffer Ø available as work area
205-304	Buffer Ø Contains Student Response
305-404	Buffer 1

Figure 6. **Student Record File, Daily File, and Backup File Format**

Source: Leslie Willis and John Stelzer. *Project IMPACT Software Documentation: II. The IMPACT Data Evaluation System—Version 2 (IDES-2),* HumRRO Research Product RP-D1-72-1, August 1972.

```
CWIP...    STUDENT NO. ...    CUBICLE..    PROC. ...    OM ...    ID.    1008    DATE   9 JAN 1973    TR 14
                                                                                  TIME:   18:57

                                  TROUBLE ..        XX IN QUIZ

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REFEREE ACTION--
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Figure 7. **On-Line Trouble Report, Page 2**

Byte	Content
0	Blank
1 - 6	Course Location Where TR was Initiated
7 - 9	Student Idenfifier
10 - 12	Cubicle Identifier
13 - 15	Proctor Initials
16 - 18	Operations Monitor Initials
19-20	Trouble Identifier
21	Special Quiz Help
22 - 99	Definition of "Other" (50) Category
100	Update Code

Figure 8. **Distribution of Data—Bytes 205 - 304**

Administration

Once a day the data in the TR file are reproduced in hardcopy and referred to the directors of the various affected activities (see Figure 2) for action. The nature of the problem determines which director is designated as the referee for that TR. A referee has three possible courses of action:

(1) If he feels that the problem/interaction is unique and not likely to recur, he can choose to take "no action."

(2) If all (or most) of the students traversing the point in the course where the problem/interaction occurred are likely to be affected, he would rectify the problem immediately.

(3) If the referee is unsure as to how many students would have difficulty with the reported problem he can table any action, pending receipt of additional TRs.

After the referee has taken action (1 or 2 above) on a TR, he writes either "fixed" or "no action required" on the TR and returns it to the proctor room. The proctor then keypunches a card for the TR, with the TR identifier and sets a status flag by punching, in column 11 of the card, 1, which means the TR is invalid; 2, which means no action is necessary; or 3, which indicates that the problem has been fixed. Cards are not punched for TRs that are not returned and a default value of Ø is set as the update code. The data on the punched cards are then merged with the TR file data and the status flag is placed in byte 304 of the TR record as the update code.

At the end of a meaningful period of time (at Project IMPACT, after each student group has completed the course), the course administrator calls for a readout of all TRs that have an update code of Ø—in other words, those TRs where action was tabled. He then checks with the referees to ensure that some action is taken on the reported problem. With this system, course administrators ensure that the individualized instruction is responsive to the expressed needs of the individual student.

However, students also have needs that they may not recognize. For example, if a question is not scored correctly the student can be penalized without realizing that this is happening. One of the duties of the proctor is to examine the formatted student record for scoring and recording errors during the end-of-module analysis. If such an error is found, the proctor again goes to the TR and enters an S8 (or what we call IP internal report). This is a non-student-initiated report, but it goes through all the procedural steps of a regular TR, with the proviso that the referee is specified by the course administrator. This type of TR must result in an update code of 3 within a minimum amount of time.

Applications

Any one of the proctor entries can be treated as a variable by the course administrator. For example, if he suspects that a specific auxiliary visual device is giving an inordinate number of problems, he can request an output that would show a frequency count of all auxiliary visual related TRs, sorted by cubicle. The output would either confirm or deny his suspicions and appropriate action could be taken. Therefore, the administrator can get output based on any entry or combination of entries on the TR, such as specific troubles, locations in the course, student, proctor, cubicle, time of day, and so forth. Because the TR is dynamic (can be added to at any time), a listing of all trouble number 50s is usually beneficial to the administrator at specified points in time. If there are numerous occurrences of a specific problem in this listing, it is desirable to add it to the regular list of troubles, and update all previous occurrences with its new alphanumeric code. Thereby, it can be manipulated in the same manner as any other trouble.

CWIP... STUDENT NO. ... CUBICLE.. PROC. ... OM ... ID. 1008 DATE 9 JAN 1973 TR 14
TIME: 18:57

TROUBLE .. XX IN QUIZ

IP	CW	HRDWRE	MISC
1 TYPO CRT	7 RESPONSE ANAL.	4 LOST CUE COUNT	5 LOCKED KBD
0 TYPO P-SCOPE	2 CURSOR POS. NG	6 P-SCOPE NG	0 P-S OFF CENTER
2 TYPO MANUAL	4 CRT SCRAMBLED	24 SYSTEM CRASH	2 MULT. CURSORS
3 CRT TEST NG	0 P-SCOPE CUE NG	2 LIGHT PEN NG	1 MISSING MATLS
0 PSCOPE TEST NG	2 WRONG BRANCH	6 CRT NG	0 IDM PROBLEM
2 MANUAL TEST NG	2 CRT BLANKED	4 LINE TROUBLE	5 S ERROR
12 DIRECTIONS UNCLR	3 WRONG FDBK	3 BULB BURN-OUT	3 CMI CUB BUSY
12 SUBJ MATTER ?	0 WRONG POINTS	1 VIEWLEX NG	5 IP INTERNAL
1 XX IN P SECTION	1 TP I/O ERROR		
2 OPTION PROB.	0 EXCESS PROC.		
3 GLOSSARY PROB			
2 PROGRAM ?			
29 PROBLEM CODE 50			

50 OTHER..

Figure 9. **Trouble Report Summary**

Another type of end-of-group report is the Trouble Report Summary, in which the alphanumeric code next to each trouble is replaced by a frequency count for that trouble. In the example shown in Figure 9 there is, let us say, an unacceptably high instance of system problems for the student group being reported on in the summary. The course administrator would inform the directors of hardware and software of the unacceptability of the situation and they are expected to rectify it. The efficacy of the solution implemented can be checked by continuing to get frequency reports during and after the next student group.

In fact, summary TRs are very helpful for assessing the success of a previous analysis and subsequent revisions. Summary data over five student groups for selected instructional and logic programming related troubles are shown in Figure 10. Between Groups 11 and 12, the course reported on underwent substantial revision. Two data points are reported in this summary (frequency and mean number of TRs per student). Because the groups have unequal Ns, the second figure, mean number of TRs generated per student, is more meaningful to examine than the totals.

	Group				
	TR11	TR12	TR13	TR14	TR15
Code = A4					
Frequency	4.00	0.00	1.00	2.00	2.00
Mean/s	0.67	0.00	0.07	0.08	0.10
Code = A7					
Frequency	23.00	7.00	5.00	3.00	1.00
Mean/s	3.83	0.47	0.36	0.13	0.05
Code = A8					
Frequency	11.00	8.00	3.00	3.00	0.00
Mean/s	1.83	0.53	0.21	0.13	0.00
Frequency Total (A)	38	15	9	8	3
Code = G1					
Frequency	13.00	15.00	20.00	4.00	10.00
Mean/s	2.17	1.00	1.43	0.17	0.48
Code = G5					
Frequency	1.00	1.00	1.00	0.00	0.00
Mean/s	0.17	0.07	0.07	0.00	0.00
Code = G7					
Frequency	5.00	1.00	2.00	0.00	1.00
Mean/s	0.83	0.07	0.14	0.00	0.05
Frequency Total (G)	19	17	23	4	11

Where: A4 = CRT Text No Good; G1 = Response Analysis Problem
A7 = Direction Unclear; G5 = Wrong Branch
A8 = Subject Matter Question; G7 = Wrong Feedback

Figure 10. **Summary of Trouble Reports—Groups 11 thru 15**

This particular example would be interpreted by a course manager (or evaluator) as reporting that the revision to the instructional text is successful, but that the revisions caused problems in the instructional logic that were not solved until after Group 13. With only small exceptions, the mean number of TRs per student was reduced from group to group. The most striking reduction in TRs is in category A7, "directions unclear." This is the type of problem that would not normally surface during the end-of-module analysis, but is empirically evident during the operational analysis when student problems are documented via the TR. It is also evident from Figure 10 that as the course is "polished" fewer student-initiated interactions occur and therefore reduced proctor staffing is possible.

Staffing requirements as a function of TR data can also be determined by the characteristics of the student population. Figure 11 shows data on the number of student-initiated reports over two divisions of a course (Hillelsohn, 1974) for high and low performers (equal Ns for all cells) in each of the divisions. It is important to note that the high and low performers were chosen, on the same criteria, separately for each division. Although there is some overlap, each cell is made up of a unique group of students. Only the criteria for assignment were constant. All system-initiated reports were eliminated for this summary. The data show that low performers initiate more Trouble Reports by about two to one than high performers for this course. To the course administrator this means that if there is a group of predicted low performers about to take the course, more proctors would be needed than if there is a group of predicted high performers. An alternative course of action would be to take this information to course evaluators/developers and have them revise the course so that the incidence of low performance is reduced, or raise the entry level requirements for the students.

Student Groups (N=20 per group)

Number of TR's Initiated in	High A	Low A	High B	Low B
Div A	17	64	21	59
Div B	31	44	25	43
A&B	48	108	46	102

Figure 11. Number of Reports Initiated by High and Low Performers

Conclusion

Student-initiated reports proved themselves to be an important data source for decision makers, both for course development and for administration. They are timely, because they enable the decision makers to get daily reports and effect prompt repairs if necessary. The reports are entered into the data base when the CAI hardware/software system is already operating for students and there is no attendant cost to inputting the operational analysis data. The only additional cost to the CAI system overhead is the cost of reporting the data, which is done via batch programs. Since it is the individual student who is initiating the report, the data are more likely to accurately reflect student perceptions of problem areas in the instruction and thereby supply an additional relevant data point for the decision maker who has to evaluate an individualized learning system.

LITERATURE CITED
AND
APPENDIX

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Appendix A

VOYEUR

COURSE NAME: VOYEUR

VOYEUR is a course only in the sense that the text is in the instructional text files and the logic is in the instructional logic files. It is really a support program to aid proctors and course managers in performing their duties.

In Project IMPACT, the VOYEUR program was used on a proctor terminal to monitor the progress of a group of on-line students. The four main elements of the program are described below:

(1) Student Status. Lists each active student by number, with the following additional information: (a) location in the course (by course label), (b) most recent quiz score (as CTR 29 =), and (c) last input to the system (as Buffer Ø =). This information is retrieved from each student's line data area and updated every time the proctor executes a PRESS SEND on the monitor terminal.

Figure A-1 shows a portion of VOYEUR output on student status. Retrieving information from each student's line data area, the program can report on 10 students at a time.

```
03/26/73    16:26

STUDENT =          255        LABEL = BIA16A       CTR 29 = Ø
BUFFERO=SIGN OFF

STUDENT =          282        LABEL = BHA00A       CTR 29 = 177
BUFFERO=LINK B
```

Figure A-1. **Portion of VOYEUR Output**

(2) Trouble Report. Presents a form to be completed by the proctor after each interaction with a student. As shown in Figure A-2, the information to be supplied by the proctor includes the following:

CWIP—course location where interaction occurred.
STUDENT NO.—identification of student needing help.
CUBICLE—student station where interaction occurred.
PROC.—initials of the proctor answering the call.
OM—initials of the chief proctor of the shift.
TROUBLE—alphanumeric code of the possible problems presented in four categories.
OTHER—explanation of the trouble code "50".

CWIP... STUDENT NO. ... CUBICLE.. PROC. ... OM ... ID. 1008 DATE 9 JAN 1973 TR 14
TIME: 18:57

TROUBLE .. XX IN QUIZ

IP	CW	HRDWRE	MISC
A1-TYPO CRT	G1-RESPONSE ANAL.	M1-LOST CUE COUNT	S1-LOCKED KBD
A2-TYPO P-SCOPE	G2-CURSOR POS. NG	M2- P-SCOPE NG	S2- P-S OFF CENTER
A3-TYPO MANUAL	G3-CRT SCRAMBLED	M3-SYSTEM CRASH	S3-MULT. CURSORS
A4-CRT TEST NG	G4- P-SCOPE CUE NG	M4-LIGHT PEN NG	S4-MISSING MATLS
A5-PSCOPE TEST NG	G5-WRONG BRANCH	M5-CRT NG	S5-IDM PROBLEM
A6-MANUAL TEST NG	G6-CRT BLANKED	M6-LINE TROUBLE	S6-S ERROR
A7-DIRECTIONS UNCLR	G7-WRONG FDBK	M7-BULB BURN-OUT	S7-CMI CUB BUSY
A8-SUBJ MATTER ?	G8-WRONG POINTS	M8-VIEWLEX NG	S8-IP INTERNAL
A9-XX IN P SECTION	G9-TP I/O ERROR		
B1-OPTION PROB.	H1-EXCESS PROC.		
B2-GLOSSARY PROB			
B3-PROGRAM ?			

50-OTHER...

Figure A-2. **VOYEUR Element for Trouble Reports**

Additional blank lines are also provided for more explanation if desired. The identification number (ID.) of the trouble report is supplied by the system, along with the date, the time, and the code of the student group (this is TR12 in Figure A-2).

In Project IMPACT, copies of these trouble reports were referred to appropriate staff specialists for solving or eliminating the problems. This Referee Action was also added to the trouble report on-line. All data entered by proctors, referees, and the system were incorporated into a data base for output by variables such as number of trouble reports per student, per course label, per type of problem, etc.

(3) System Status. Pre-formatted command of the executive program (Zeus) that allows a proctor to inspect the status of the system, including the latest messages on the console, the size of the partitions, and the relative activity of each partition in the main computer.

(4) Display. Pre-formatted command of the executive program (ZEUS) that allows a proctor to quickly look at any element in the course.

The proctor can move easily from one element to another in VOYEUR by entering on the CRT screen a one-character designator that initiates an immediate branch to the element desired. These designators are:

V for Student Status,
T for Trouble Report,
S for System Status
Y for Display.

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Cybernetics	Instructional programs	
	Operational analysis	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Operational analysis is defined as a part of formative evaluation, taking place while a course is in progress. Student-perceived problems, as reflected by student-initiated reports, are the source of data for this phase of formative evaluation. The self-reporting techniques can reveal individual differences in student/learning-environment interactions which are not obtainable (or are difficult to obtain) by other means. The individual student's perceptions can then be used to improve the instructional program.

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20. Abstract (Cont.)

This technique (report) is described and some applications of the data for administrative purposes are discussed. The administrative staffing for the IMPACT operational CAI course(s) is described.