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ABSTRACT

An on-line information system was designed and implemented in an elementary school using a time-sharing DEC-15 computer system to facilitate the management of individualized instruction. The system stores students' background information, test data, and instructional tasks. Teachers and researchers were able to retrieve desired data using either the standardized reports or the flexible QUERY program. The paper emphasizes how the data base structure contributes to retrieval speed and output format flexibility, and how the organization of the system facilitates data base updating and student data utilization for monitoring student programs. (Author/SK)

THE DESIGN AND IMPLEMENTATION OF AN ON-LINE INFORMATION SYSTEM TO FACILITATE THE MANAGEMENT OF INDIVIDUALIZED INSTRUCTION

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THE DESIGN AND IMPLEMENTATION OF AN ON-LINE INFORMATION SYSTEM TO FACILITATE THE MANAGEMENT OF INDIVIDUALIZED INSTRUCTION

It is generally agreed that if instruction is adapted to the specific learning needs of the individual it will be more effective. In order to determine specific instructional needs, it is necessary to diagnose student characteristics prior to instruction and then use the diagnostic test results as the basis for prescribing alternative instruction. Then, in order to assure individual progress, student performance is monitored and repeatedly assessed. In addition to monitoring student progress, it is necessary to collect data to assess the effectiveness of the instructional assignments and tests to evaluate the tools of the learning model. All of this requires a great deal of recordkeeping, and efficient information retrieval procedures. For these reasons, computer assistance is indispensable for an effective individualized instruction system.

The computer can be used to assist in the management of instruction in many ways. It can be used to administer tests, to process student data, to display instructional options, or even to conduct instruction. However, the focus of this paper will be the design and implementation of an on-line information system to facilitate the management of individualized instruction.

Oakleaf School Information Retrieval System

The overall goal of this system is to store and retrieve instructional and testing data for the purpose of monitoring student progress, making instructional management decisions, making curriculum evaluations, and conducting research. More specifically, the implementation of this system was attempted in order to: (1) provide specific real-time data, (2) provide periodic status reports to replace time consuming hand-prepared recordkeeping, (3) classify data in a systematic, meaningful manner, and (4) accumulate essential statistics internally for later analysis.

The best way to understand this system is to trace the information flow as given in Figure 1. The information flow is divided into ten steps with initialization as the first step. Prior to the beginning of each academic year either the programmer or the computer operator will remove all of the previous year's data from the system and create a new student roster with updated background information (i.e., latest standardized achievement test scores, class and grade changes, and the names of new students).

After a new roster is entered, the system is ready for data gathering. As described in Step 2 (Figure 1), the aide for each class enters student data through Cathode Ray Tube (CRT) terminals at the end of each day. This data is obtained from prescription sheets prepared by teachers. By using the program GATHER, new data is entered. This data makes up the temporary or t-files. When the aide completes the entering of all data for a class, (s)he immediately lists the t-files and checks the accuracy of the data as shown in Step 3. If errors are discovered, the aide uses the CHANGE program to make any necessary corrections on the t-files. When the t-files have been checked and corrected, the aide notifies either the programmers or computer operators so that they can incorporate new t-files into the permanent data base as described in Steps 4 and 5. Before updating the data base, the computer operator copies the t-file onto DECTAPE as a backup measure. When the copying process is complete, the program UPDATE will be executed in order to

Step	Person(s) Responsible	Activity	When	Program(s) Used	Consequence(s)
1	Programmer or Operator	Initialization of the information system.	At the beginning of each academic year.	ROSTR CODER	(a) Data for previous year are deleted from the system (b) A new student roster with updated background information is created.
2	Aides	Entering students' data based on prescription sheets through CRT terminals (Datapoint 3300).	At the end of each day.	GATHER	(a) Temporary (t)-files are created.
3	Aides	Verifying the accuracy of the data entered.	At the end of each GATHER run.	LISTT CHANGE	(a) t-files listed, verified, and corrected.
4	Operator	Copying of t-files to DECTAPE for backup purposes.	Before updating the t-files to the data base.	MGTAPE	(a) Back-up DECTAPE is created and checked.
5	Operator	Incorporating the t-file into the permanent data base.	After receiving the information that the t-files have been verified.	UPDATE	(a) Incorporation of new data into the Inverted and Direct files.
6	Programmer	Delete incorrect data from the permanent data base.	Any time that an error is discovered.	DLDBRC	(a) Error deleted from the data base; correct data should be entered using GATHER.
7	Operator	Generation of standard periodic reports for each class.	At the end of each week.	REPOR1 REPOR2	(a) Printing of Report 1 and Report 2 for each class. These reports are delivered to the school.
8	Users (teachers, supervisory personnel, curriculum developers, test constructors, etc.)	Retrieving students' data using standard reports.	Any time.	STREP1 PREMAS STREP2 PSMAS GCSUM, ACS IDDATA UNSC DAYSUM etc. SKFILE	(a) Desired standard reports are printed.
9	Users	Retrieving students' data using interactive mode.	Any time.	QUERY	(a) Desired students' data are printed according to the format specified by the users.
10	Programmer or Operator	Copying the Direct files on DECTAPE for storage.	At the end of each academic year.	DFTAPE	(a) Data for entire year are stored on DECTAPES. The data base for the whole year can be recreated for later use.

Figure 1

The Operation of the Oakleaf School Information Retrieval System incorporate the t-files into the permanent data base, which consists of Inverted and Direct files. (The structure of the data base is presented in the next section.) If any errors are discovered after the incorporation of the t-file into the permanent data base, the program DLDBRC may be used to delete the incorrect data. Substitutions for this deleted data must be entered subsequently through GATHER.

After executing the UPDATE program, new data will exist in the permanent data base and, therefore, any retrieval programs executed subsequently will reflect these additions. As shown in Step 7, the computer operator will generate two regular reports for each class. Each report includes a weekly summary of students who have completed a skill or unit, a list of students who did not complete any skills, and students who failed curriculum embedded tests or posttests more than once. These reports are useful for teachers in monitoring the progress and status of students. Examples of these two reports are shown in Figure 2.

As shown in Step 8, other standard reports can be requested at any time by teachers, supervisory personnel, curriculum developers, test constructors, and researchers. The advantage of these standard reports is that they are very easy to use. Each standard report has a specific format of output and the type of variables printed are fixed. However, since the type of variables printed are fixed, some of the output printed may not be needed by all users. Some sample outputs for standard reports are given in Figures 3 through 7.

The QUERY program listed in Step 9 was designed for interactive information retrieval. In using this program, the user must specify the types of variables to be retrieved and the sequence of variables to be printed. The advantages of this program are that users can specify the

REPORT 1
WEEKLY PROGRESS REPORT DAYS 110-114
GRADE 5-1

STUDENTS WHO COMPLETED A UNIT DURING THIS TIME PERIOD

STUDENT	UNIT	DAY OF PRE/SEM	DAY OF COMPL
DOE, JOHN	FMULT	101	114
SMITH, HARRY	ESOM	96	110
JONES, BOB	GAPP	93	113
JACOBS, BILL	EGEO	83	114

STUDENTS PROGRESS IN UNITS WITH STATUS CURRENT

STUDENT	UNIT	PRE	SKILL ACTIV MASTERED	DAY OF ACTIV	# OF UNITS COMPLETED (TO DAY)	
WONDERS, ALICE	M/36	99	F /PCET	112	0 (116)	
SMART, SUSAN	EFRAC	106	6 /PPRE	111	3 (116)	
			7 /PPRE	111		
MOUSE, MIKE	FAPP	93	3 /PCET	113	4 (116)	
			4 /PCET	114		
JOHNS, JODY	FDIV	93	2 /PCET	110	6 (116)	*15*
			3 /PCET	114		

STUDENTS WHO DID NOT HAVE A DECISION MASTERY

STUDENT	UNIT	PRE DAY	# OF UNITS COMPLETED (TO DAY)
PAN, PETER	FAPP	105	5 (116)

THE NUMBER ENCLOSED IN ASTERISKS FOLLOWING THE # OF UNITS COMPLETED SIGNIFIES THAT THIS STUDENT HAS SPENT LONGER THAN THIS EXPECTED NUMBER OF DAYS WITHIN THIS UNIT. PLEASE DO A QUERY INDIVIDUAL PROFILE TO DISCOVER WHY.

REPORT 2: COVERING UNITS WITH STATUS CURRENT AS OF DAY 116
FOR GRADE 5 AND CLASS 1

STUDENTS WHO HAVE FAILED THE SAME CET MORE THAN ONCE

STUDENT	ACTIV	UNIT	SKILL	DAY OF ACTIV	#C	#T	#OF UNITS COMPLETED (TO DAY)
LAMB, MARY	PCET	FAPP	3	100	2	5	4 (116)
				105	2	5	
				111	3	5	

THERE ARE NO STUDENTS WHO HAVE FAILED THE SAME POST TEST MORE THAN ONCE

Figure 2

Sample Outputs for Report 1 and 2: A Weekly Summary of Students' Progress for Each Class

```
TYPE THE NAME OF THE PROGRAM YOU WANT TO RUN
◆◆◆ PREMAS


UNIT SUMMARY - PROPORTION OF PRETEST SKILLS MASTERED THE FIRST TIME
TYPE STOP TO TERMINATE REQUESTS


UNIT◆◆◆M/40
START WITH DAY NUMBER ◆◆◆40
END WITH DAY NUMBER,  ◆◆◆60
UNIT◆◆◆STOP
```

PROPORTION OF PRETEST SKILLS MASTERED FIRST TIME

M/40

DAY NUMBER 40 THROUGH 60

GRADE 3 2 STUDENTS

SKILL	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11
#MASTERED	2	1	0	0	0	0	0	0	0	0	0
#TESTED	2	2	2	2	2	2	2	2	2	2	2
%MASTERED	100	50	0	0	0	0	0	0	0	0	0

GRADE 4 2 STUDENTS

SKILL	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11
#MASTERED	1	1	0	0	0	0	0	0	0	0	0
#TESTED	2	2	2	2	2	2	2	2	2	2	2
%MASTERED	50	50	0	0	0	0	0	0	0	0	0

ALL GRADES 4 STUDENTS

SKILL	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11
#MASTERED	3	2	0	0	0	0	0	0	0	0	0
#TESTED	4	4	4	4	4	4	4	4	4	4	4
%MASTERED	75	50	0	0	0	0	0	0	0	0	0

Figure 3

Sample Output for PREMAS: A Summary of the Percent of Students Who Mastered Each Skill on a Pretest

```
UNIT***M/11
START WITH DAY NUMBER ***1
END WITH DAY NUMBER ***45
UNIT***STOP
```

REPORT ON POSTTEST PASSAGE FOR UNIT M/11
DAY NUMBER 1 THROUGH 45

GRADE 1

ID	DAY OF TEST	RESULT
1047	31	PASSED
9283	37	PASSED
9317	35	FAILED
	40	PASSED
9352	44	FAILED
9385	44	PASSED
9396	36	PASSED
9432	23	PASSED
9476	12	FAILED
	18	FAILED
9487	42	PASSED
9578	17	PASSED
9614	18	PASSED
9636	41	PASSED
9647	44	PASSED
9669	41	PASSED

14 STUDENTS INVOLVED

#TIMES TAKEN	1	2	3	4	5	6	>6
#WHO PASSED	11	1	0	0	0	0	0
#TESTED	14	2	0	0	0	0	0
%PASSED	78	50	0	0	0	0	0

ALL GRADES

14 STUDENTS INVOLVED

#TIMES TAKEN	1	2	3	4	5	6	>6
#WHO PASSED	11	1	0	0	0	0	0
#TESTED	14	2	0	0	0	0	0
%PASSED	78	50	0	0	0	0	0

Figure 4

Sample Output for PSMAS: A Sample of the Posttest Passage for a Unit

STATUS REPORT FOR IM ON DAY 9

CLUSTER	UNIT	K-1	K-2	1-1	1-2	2-1	2-2	3-1	3-2	4-1	4-2	TOTAL
		GRADE-CLASS										
I	1	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0
	5	0	0	0	0	0	0	0	0	0	0	0
	6	0	0	0	0	0	0	0	0	0	0	0
	7	0	0	2	0	0	0	0	0	0	0	2
	8	0	0	5	1	0	0	0	0	0	0	6
	9	0	0	5	10	1	0	0	0	0	0	16
	10	0	0	11	9	0	0	0	0	0	0	20
	11	0	0	1	2	0	0	0	0	0	0	3
	12	0	0	0	0	0	0	0	0	0	0	0
	13	0	0	0	0	0	0	0	0	0	0	0
SUB-TOTAL		0	0	24	22	1	0	0	0	0	0	47
II												
III												
IV	36	0	0	0	0	0	0	4	1	3	1	9
	37	0	0	0	0	0	0	2	2	1	1	6
	38	0	0	0	0	0	1	0	0	0	2	3
	39	0	0	0	0	0	0	0	0	0	0	0
	40	0	0	0	0	0	0	3	5	3	3	14
	41	0	0	0	0	0	0	0	1	0	1	2
	42	0	0	0	0	0	0	0	0	0	0	0
	43	0	0	0	0	0	0	0	0	0	0	0
	44	0	0	0	0	0	0	0	0	0	0	0
	45	0	0	0	0	0	0	1	2	0	4	7
SUB-TOTAL		0	0	0	0	0	1	10	11	7	12	41
TOTAL		0	0	24	22	21	22	23	21	8	12	153

Figure 5

Sample Output for STREP1: The Number of Students in Each Unit of Individualized Math at a Specific Time

```
*RUN
TYPE THE NAME OF THE PROGRAM YOU WANT TO RUN
*** SKFILE
```

NUMBER OF DAYS BY SKILL - UNIT SUMMARY

NUMBER OF DAYS BY SKILL

EMULT

DAY NUMBER 1 THROUGH 35

ID	SKILL 1	2	3	4	5	6	7	8	9	10	11	TOTAL
4663	2.0	2.0	2.8	3.6	2.4	2.0	2.0	0.0	0.0	0.0	0.0	17.0
4058	2.7	2.3	3.5	3.1	2.7	2.3	6.2	0.0	0.0	0.0	0.0	23.0
4162	4.1	2.9	4.9	4.9	3.7	3.3	3.3	0.0	0.0	0.0	0.0	27.0
4253	1.4	1.4	1.4	1.4	1.4	1.4	2.4	0.0	0.0	0.0	0.0	11.0
4264	1.7	1.7	2.0	2.3	1.7	1.7	2.0	0.0	0.0	0.0	0.0	13.0
3352	0.4	4.7	0.4	4.0	3.2	3.2	2.2	0.0	0.0	0.0	0.0	18.0
3682	0.3	3.0	2.7	5.3	3.0	3.0	4.7	0.0	0.0	0.0	0.0	22.0
3705	0.4	0.4	0.4	0.4	0.4	0.4	1.5	0.0	0.0	0.0	0.0	4.0

SKILL	MEDIAN # OF DAYS SPENT IN THE UNIT	#OF DAYS SPENT MINIMUN	MAXIMUM
1	1.6	0.3	4.1
2	2.2	0.4	4.7
3	2.3	0.4	4.9
4	3.4	0.4	5.3
5	2.6	0.4	3.7
6	2.2	0.4	3.3
7	2.3	1.5	6.2
8	0.0	0.0	0.0
9	0.0	0.0	0.0
10	0.0	0.0	0.0
11	0.0	0.0	0.0
TOTAL	17.5	4.0	27.0

```
STOP 000000

/E: EXIT
```

Figure 6

Sample Output for SKFILE: The Number of Days Spent in Each Skill for Every Student in a unit

TEST ACTIVITY SUMMARY BY CLASS

NAME OF ACTIVITY: PAPER AND PENCIL DAYS 1- 25

#P=NUMBER OF TIMES TEST WAS MASTERED
#I=NUMBER OF TIMES TEST WAS TAKEN

CLASS	UNIT	PRE	ACTIVITY CET	POST	TOTAL TESTED	EX.P.
	ENPV					
3-1	#P	0	4	0	4	0
	#I	1	5	1	7	1
3-2	#P	0	0	0	0	0
	#I	0	0	0	0	0
4-1	#P	0	21	4	25	0
	#I	4	23	4	31	0
4-2	#P	0	9	1	10	0
	#I	2	9	2	13	0
5-1	#P	0	21	4	25	0
	#I	4	26	5	35	0
5-2	#P	0	13	0	13	0
	#I	2	20	3	25	4
SUB	#P	0	68	9	77	0
	#I	13	83	15	111	5
TOTAL	#P	0	68	9	77	0
	#I	13	83	15	111	5

Figure 7

Sample Output for ACS: A Test Activity Summary By Class For Each Unit in a Specified Time Period information that should be printed and the retrieval time will be short. However, in order to accelerate retrieval time, this program was designed to copy the data base as it exists without any sorting or tabulation. If any tabulation is required, a standard program is prepared to obtain such data. A sample QUERY run is given in Figure 8.

At the end of each academic year, the Direct files will be copied onto DECTAPE for storage as shown in Step 10. Whenever the data base for a particular year is needed, that year's complete data base can be re-created in a few hours. Therefore, even if data is removed from the disc, it can be retrieved for longitudinal studies.

Structure of the Data Base

Each student activity is reduced to a list of attribute-value (A-V) pairs. This list is kept as a record in the data base and is the basic unit of retrieval. An attribute is a label assigned to each field within a record. The content of any field in a record is its value. The number of attributes for any given activity is fixed. A simplified example of A-V pairs is given in Figure 9.

The primary data sets in the system are the Direct file and the Inverted file. The Direct file consists of records, each of which has a special RIN (Record Identity Number). Each record contains a description of a student's activity in the form of an attribute-value list. Only the values are stored, because the attributes are implicit in the format. The records in the Inverted file contain a list of RINs that reference those records in the Direct file containing a particular attribute-value pair. Each logical record in the Inverted file corresponds to a unique A-V pair in the Direct file. The Direct file is never searched. Instead,

```
DO YOU WANT INSTRUCTIONS? *** YES
*
*
A. WHEN "HEADING" APPEARS, FROM TABLE 4 TYPE ATTRIBUTES        *
   (SEPARATED BY COMMAS), THAT YOU WANT PRINTED. TYPE THEM     *
   IN THE ORDER YOU WANT THEM PRINTED ACROSS THE PAGE. DO      *
   NOT SPACE.                                                  *

B. WHEN "TITLE" APPEARS, TYPE A REPORT TITLE OR JUST HIT       *
   CARRIAGE RETURN.                                            *

C. WHEN "1," APPEARS, TYPE AN ATTRIBUTE A COMMA AND ONE OR     *
   MORE VALUES (SEPARATED BY COMMAS). LIMIT: 10 VALUES.        *

D. THE COMPUTER WILL CONTINUE TO PRESENT YOU WITH 2,3,,,,,     *
   FOR EACH OF THESE ENTRIES FOLLOW THE PROCEDURE IN C ABOVE.  *
   THESE ARE THE DETERMINANTS OF YOUR RETRIEVAL. WHEN YOU      *
   HAVE MADE ALL SPECIFICATIONS YOU DESIRE TYPE "GO" IN        *
   RESPONSE TO ONE OF THE NUMBERS PRESENTED.                   *

HEADING: NAME,GRADE,CLASS,DATE,SKILL,#CORR,#TEST,DECIS

TITLE: PUPILS WHO HAVE FAILED COMPUTER CET IN SKILL 8 OF E DIVIDE

1. UNIT,EDIV

2. SKILL,8

3. ACTIV,CCET

4. DECIS,NMAS

5. GO
```

NAME	GRADE	CLASS	DATE	SKILL	#CORR	#TEST	DECIS
BELL,SALLY	5	2	48	8	7	10	NMAS
BELL,SALLY	5	2	50	8	4	10	NMAS
BELL,SALLY	5	2	52	8	7	10	NMAS
BROOKS,TOM	4	1	53	8	6	10	NMAS
COX,JIM	5	2	62	8	7	10	NMAS
GREEN,TIM	4	1	73	8	7	10	NMAS
SMITH,RUTH	4	2	94	8	7	10	NMAS
SMITH,RUTH	4	2	97	8	6	10	NMAS
WOODS,JOHN	5	2	99	8	7	10	NMAS
WOODS,JOHN	5	2	100	8	6	9	NMAS

Figure 8
An Example of QUERY Output

INVERTED FILE

A-V Pair	RINs			
A-1	1	-	-	-
A-2	3	-	-	-
A-3	2	-	-	-
B-0	1	2	-	-
B-1	3	-	-	-
B-2	-	-	-	-
C-1	-	-	-	-
C-2	3	-	-	-
C-3	1	2	-	-

DIRECT FILE

Record Identity Number (RIN)	A	B	C
1	1	0	3
2	3	0	3
3	2	1	2

ATTRIBUTE: Possible Values

A (Name): 1 (John Doe), 2 (Doris Smart), 3 (Jim Cox)

B (Activity): 0 (paper placement test), 1 (computer pretest), 2 (computer posttest)

C (Date): 1 (May 5), 2 (May 6), 3 (May 7)

Examples of Student Activities	List of A-V Pairs Describing the Activities
(1) John Doe took the paper placement test on May 7.	(A-1)(B-0)(C-3)
(2) Jim Cox took the paper placement test on May 7.	(A-3)(B-0)(C-3)
(3) Doris Smart took the computer pretest on May 6.	(A-2)(B-1)(C-2)

Figure 9

An Example of Using A-V Pairs in Data Retrieval the particular records (identified by their RINs) pertinent to a request are found using the Inverted file and only those records are read. For example, in a retrieval request for activities containing C-3 (activities occurred on May 7 in Figure 9), we first read the Inverted files to find RIN 1 and 2. Then, from the Direct file, we read records 1 and 2 which will each contain a (C-3) pair. This kind of file structure can reduce retrieval time substantially (Bloom, 1969).

In addition to having the general advantages of the Inverted file, there are several additional features which reduce storage requirements and retrieval time. In the Direct file, each record is formulated into 14 fields of specific bit lengths. Each field corresponds to a particular attribute and the bit configuration within that field supplies the value of that attribute. By using only the number of bits necessary to cover the total range of values for each attribute, storage requirements are significantly reduced. Storage requirements are further reduced by reading and writing from the disc in Binary format rather than ASCII (character). Using the above scheme, one record containing approximately 142 characters of information is stored in the equivalent of 38 character positions.

In order to reduce retrieval time, the Inverted files and Direct files are distributed over 30 login numbers (LOG - LOG+29). A scheme to simulate disc random access, which our software does not support, was developed using modulo arithmetic. The Inverted file is fragemented by attribute-value pairs (each A-V pair is represented by a unique data set name). To access a particular Inverted file say IXXX:MGM, where XXX is a unique numerical code, the login number is given by:

Login No. = LOG + MOD(XXX,30),

where MOD(XXX,30) is the remainder resulting

from integer division of XXX by 30.

The Direct file is fragmented into sub-files of fixed length n. To locate Direct file record number c, the login number is computed from:

Login No. = LOG + MOD(YYY,30),

where YYY is the integer quotient resulting

from the division of c by n (Direct file fragment number).

The record number within the fragment DYYY:MGM for c is given in MOD(c,n). This process allows the retrieval programs to find the shortest path within the fragment to the record in question.

Implementation of the Information System

The system has been implemented at the Oakleaf School, which is one of the elementary schools experimenting with Individually Prescribed Instruction (IPI) with the Learning Research and Development Center. After discussions with the potential users of the system (e.g., teachers, school administrators, curriculum developers, and researchers) the following types of data were collected and maintained in the system: (1) information concerning the student's background (e.g., student's name, ID number, grade, class, latest IQ and achievement test scores, last unit studied [or placement data]), (2) test results that consist of data from placement tests, pretests, Curriculum Embedded Tests (CETs) and posttests, and (3) the instructional task (e.g., lesson booklet, textbook, computer program) prescribed by the teacher.

Although the system was designed for data in various subject areas, only math data for about 200 students from grade 1 through grade 5 were collected and stored in the data base during the 1973-74 academic year. During the 1974-75 school year, two classes in kindergarten were also included in the data base. Teachers' aides were trained to enter data from the students' prescription sheets using the Datapoint 3300, and also to use the Texas Instrument model 725 to list the temporary files and make corrections if necessary. On the average, an aide initially required approximately 30 minutes to enter one day of math data for a class of 20 students. The time required for data entry was reduced as the aides became more familiar with the terminal. The temporary files created by the aides each day can be converted to the permanent data base in about an hour. Teachers and supervisory personnel were given a preliminary version of the manual (Hsu, et al., 1974) in November 1973. The manual described calling procedures and information provided by the users' programs. Further discussion and demonstrations of the uses of the outputs from these programs were conducted at meetings held during the following two months before hand prepared records were eliminated.

In managing the instruction, Report 1 (REPOR1), Report 2 (REPOR2), and the interactive program QUERY are used most frequently. REPOR1 and REPOR2 are generated weekly and distributed to teachers and supervisory personnel. Both reports are printed so that information is separated according to grade and class. The type of information contained in each report is illustrated in Figure 2. Notice that a special flag, an asterisk, is used to call attention to a student who is spending an unusually long time in a unit (as compared with the time data for the unit from the preceeding year). A teacher can then use the QUERY program to retrieve a complete individual profile of a student in order to review his/her particular problem or for a parent conference. QUERY can also be used to identify groups of students with similar characteristics for small-group instruction. GCSUM, another standard report that is regularly used, provides a summary of units completed by each student within a specified time period. Teachers use GCSUM to prepared student report cards.

The QUERY program is also used frequently by the principal to obtain data for management and administrative purposes. The principal also reviews Report 1 and Report 2 to initiate discussion with teachers. When an overall distribution of students in the math curricula is needed, the principal uses status reports 1 and 2 (see Figure 5). These reports tabulate the number of students in each unit for both IPI (Individually Prescribed Instruction) Math and Individualized Math.

Since the data needs of curriculum evaluators and researchers often focus on the effectiveness of instructional materials and tests, various standard reports have been prepared to meet these needs. Figures 3, 4, 6, and 7 provide typical examples. PREMAS in Figure 3 shows a summary of the percent of students who passed each skill on a pretest. PSMAS in Figure 4 provides a summary of the posttest passage in a specified unit. This information is useful in understanding the difficulty level of each skill and each unit for a grade level. Another indication of the difficulty of a skill is the average number of days students spend in a skill. SKFILE in Figure 6 illustrates the data that are collected for this purpose. Standard reports were also prepared to tabulate data about each type of achievement test device (e.g., computer testing, paper and pencil test, see Figure 7) and each type of instructional activity (e.g., CAT lessons, lesson booklets). All of these reports are useful for curriculum and test evaluation. Nevertheless, QUERY is the program which continues to be used most frequently by evaluators and researchers because it is the most flexible in terms of the types of data that can be obtained (see Figure 8).

Since this system is still in the process of development, a formal evaluation has not been conducted. However, our experience may be summarized as follows: (1) Preliminary reactions to the retrieval system have been favorable. (2) The data in the data base are current to the preceeding school day. (3) Even though 25,000 records of data base are in the DEC-15 system, retrieval time for the QUERY program is fast. (4) Retrieval time for standard reports (which are printed by the computer operator after school hours) is longer than QUERY since these reports require sorting in addition to searching. However, it usually requires about two minutes to print these reports for one class. (5) The type of information and the format of printing is flexible in the QUERY program. (6) Preparation of a special program used for retrieving data that cannot be easily obtained by the QUERY program, in most cases, is a reasonably easy task. (6) The disc space is efficiently used by binary coding of the information. (7) The system is helpful in assessing an individual student, grouping students according to similar characteristics, planning instructional activities, evaluating instructional and testing materials, and collecting data for research.

Summary

In summary, this system has accomplished most of the objectives stated previously. Specific data can be retrieved on-line in various ways with an acceptable waiting time. Standardized reports have been used every week to replace a weekly summary previously hand prepared by aides. When the system has passed the initial field testing, other school recordkeeping practices may be aided and/or replaced by computer reports (e.g., elimination of hand-prepared paper prescription sheets). Although it is too early to determine the impact of the system on the effectiveness of managing individualized instruction, there are several observations that can be made. First, the students' daily activities can be monitored more systematically and easily by teachers and supervisory personnel. Second, instructional management problems can be discussed on the basis of actual data rather than on impressions. Third, researchers need not be overwhelmed by an unmanageable amount of data. If a researcher asks a meaningful question based on the data maintained, this information system can provide a meaningful answer arranged in an organized fashion. And last, the system is designed to facilitate the combination of the management system with computer-assisted instruction, computer-assisted testing, and computer-assisted prescription into an integrated computer-based instructional system. Initial results show that the potential for such an integrated system is positive.

References

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