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ABSTRACT

A teacher's manual for operating the DX System, a software package for use in diagnostic testing programs, is presented. The DX System is constructed to present test items based on the individual student's pattern of responses. Described are: (1) system components designed to run on an Apple II computer; (2) program options allowing the user to administer tests, collect summary reports, and input new and revised tests; and (3) a system demonstration taking the user through a step-by-step test administration and summary of results, using two prototype tests measuring student performance in pronoun usage and reading comprehension. Included in a section on DX System implementation are subdivisions on test construction, entry of test items, test administration, summaries of results, and teaching and retesting. Samples are given showing test item layout and test performance summaries. A flow chart of test item presentation follows the text. (LMO)

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DIAGNOSTIC TESTING

Teacher's Manual for
Using the DX System

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TEACHER'S MANUAL FOR USING THE DX SYSTEM

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INTRODUCTION TO THE DX SYSTEM

The DX System is a software package for use in diagnostic testing programs. It is designed for individual student assessment of specific skills and/or content within identified domains. Student performance within a domain is diagnosed by assessing both requisite and prerequisite skills during a specially-designed presentation of test items at various levels of difficulty.

The DX System is constructed to present test items based on the individual student's pattern of responses. This capability of individualized testing allows the DX System to identify each student's strengths and weaknesses within a domain. In addition to skill need identification, the DX System is capable of recording and integrating test results to provide a summary report of student performance. These reports are essential for planning a complete diagnostic-prescriptive program of instruction.

The DX System gives the user several kinds of diagnostic information. The key features of the summary data for each student include identification of performance level, specific skill needs, and types of errors made. In order for this information to be accurate, tests must be constructed using guidelines and directions provided in the diagnostic test construction manual.

In summary, the DX System is a specially-designed adaptive diagnostic testing package that combines educational diagnosis, psychometric theory, and computer technology. As a diagnostic tool, the DX System identifies a student's strengths and weaknesses and provides specific information for subsequent prescription. The flow of test item presentation reflects key

psychometric considerations--multiple levels of difficulty, distractors related to error types, and decision paths. The interaction and information-processing needed for sophisticated diagnostic testing are best accomplished in a computerized approach (McArthur & Choppin, 1984).¹ These features are efficiently handled by the DX System through the use of Pascal programming and the Apple computer.

The DX System has been developed for use in programs requiring a systematic, comprehensive approach to diagnosis. Tests constructed for use in the DX System must follow specified guidelines. Two prototype tests are currently in the system for use in demonstrations and training sessions. These tests measure student performance in pronoun usage and reading comprehension.

¹ McArthur, D. L., & Choppin, B. H. (1984). Computerized diagnostic testing. Journal of Educational Measurement, Vol 21(4), 391-397.

DX SYSTEM COMPONENTS

The DX System contains three diskettes:

Diskette A--the system files

Diskette B--the test files

Diskette C--the test edit files

The DX system runs on an Apple II (II plus, IIe) computer. System requirements include a memory card to increase memory to 64K, a video monitor, and two disk drives. A printer is optional.

The three diskettes included in the package provide all the necessary program components. As multiple tests are constructed, however, additional test files diskettes (Diskette B) will need to be made. Setting up test files is addressed in Section V.

DX PROGRAM OPTIONS

The DX System allows the user to administer tests, collect summary reports, and input new and revised tests. The names for these options are described below.

1) RUNTEST-

RUNTEST is the name of the file that is used for test administration. RUNTEST administers tests, accepts students' responses, delivers feedback and tracks student performance to make decisions on the testing sequence. RUNTEST is also the word that is entered at the keyboard to start the testing process. This option is demonstrated in Section IV.

2) SUMMARY-

SUMMARY is the name of the program that processes students' records of test performance. SUMMARY analyzes students' responses and error patterns and presents individual performance summaries. SUMMARY is also the word that is entered at the keyboard in order to see a display of test results. See Section IV for a demonstration of SUMMARY.

****Diskettes A and B are used when running RUNTEST and SUMMARY.****

3) EDITTEST-

The EDITTEST file on Diskette C allows the user to input new and revised test items. This process is explained in Section V.

DX SYSTEM DEMONSTRATION

This section takes you step-by-step through test administration and summary of results, using the pronoun and comprehension tests provided on Diskette B.

A. BEFORE YOU BEGIN - An important preliminary step is making back-up copies. Follow the directions in your Apple user's manual to copy diskettes A, B, and C. Store the back-up diskettes for use in the event that an original diskette fails.

B. TEST ADMINISTRATION -

Preparation 1 - With the computer off, insert diskette A (label side up) into drive #1 and diskette B (label side up) into drive #2.

2 - Next, turn on the computer and the video monitor.

3 - In a few moments, the screen displays the following command selections:

```
Command: E(dit R(un F(ile C(omp L(ink
          X(ecute A(ssem D(ebug?
```

Type X for execute. Your command is immediately processed.

4 - When asked "Execute what file?" type RUNTEST and press RETURN.

Test-taking

1 - The test session begins with the message:

"Please type your first and last name and finish with the RETURN key"

The name entered at this point becomes the filename for the student's file of test results. Students should enter first and last names.

2 - The next screen display greets the student and introduces the test. The information is displayed for a short time and then the first pronoun test item appears.

3 - For each test item, select the letter of the correct response. As soon as a letter is typed the program processes the response and provides immediate feedback.

- 4 - If a student types a letter other than the available choices, this message appears:

"Try again . . . Choose one letter for the best answer."

After three entry errors, the correct response is displayed and the next test item is presented.

- 5 - Depending on the pattern of responses, up to 12 test items are presented. After the final item, results for the pronoun test are recorded and stored on diskette B. As this process is being done, you see the message:

"Please wait"

The comprehension test follows immediately after this step.

- 6 - Continue answering comprehension questions as before. Depending on the pattern of responses, up to 12 items will be presented. (See appendix A for a description of the flow of test item presentation.)

After the last comprehension test item the "Please wait" message is displayed while test results are recorded.

- 7 - The testing session is finished when this message appears:

"Thank you"

C. SUMMARY OF TEST RESULTS

Viewing the
Results

- 1 - To execute the SUMMARY program, type the X command when this line is displayed -

Command: E(dit R(run F(ile C(omp L(ink
X(ecute A(ssem D(ebug?

- 2 - When asked "Execute what file?" type SUMMARY and press RETURN
- 3- The Catalog of test results files is then displayed on the screen. Note that entries are written in the following form -

first initial. last name. first letter of test.

Find your filename and type it exactly as it is listed on the catalog. An example is displayed on the screen. When finished, press RETURN.

- 4 - At the bottom of the screen is the question:

"Do you want to print this student's summary? (Y/N)"
If no, type, N and press RETURN. If yes, TURN PRINTER ON and then type Y and press RETURN.
- 5 - The results of the test you selected are displayed on the screen. Figure 1 contains some additional sample test summaries.

Note the following types of data:

- # of items attempted & # of items correct
 - % correct overall
 - % correct within levels
 - number and type of errors made
 - the test items for which the errors apply
- 6 - When finished printing or reviewing results, press RETURN to return to catalog or type the FILENAME you wish to review next. If completely finished type BYE and press RETURN.

Deleting Student Files

Summary information is stored on Diskette B until the file is deleted. Up to 12 student files (depending on the length of the tests on the diskette) can be stored on a diskette. To delete a student file, follow this sequence:

1. When the Command selection is displayed, type F for File
2. Next, type R when the list of files commands is displayed.
- 3- When "Remove?" is displayed, type #5: FILENAME. TEXT (use the filename to be deleted).
- 4- The question "Update directory?" allows you to check your entry before removal. If this is the correct file to be deleted, type Y. If not type N and repeat step 2 through 4.
- 5- Type Q for quit. When the command line appears either execute (X) a new file or turn off the compute .

In actual use, the procedures for test administration, summary of results and removal of student files, remain constant regardless of the test being used.

DX SYSTEM IMPLEMENTATION

The complete DX System Implementation includes:

- A. Test construction
- B. Entry of test items
- C. Test administration
- D. Summary of results
- E. Teaching and re-testing

A. Guidelines for diagnostic test construction are provided in the manual entitled "Test Design Manual: Guidelines for Developing Diagnostic Tests". The DX program is designed to fit a wide range of testing protocols, excluding only those tests which require free response. When constructing diagnostic tests for the DX system, certain considerations must be followed. These are described in Part B.

B. The design of the DX System requires a diagnostic test with the following features (see Appendix 2):

- 3 levels of difficulty (or skill type)
- 2 passages (sentences, problems) per level
- 3 questions per passage - each identified by error type

This totals 18 questions for each test. Each complete test item (1 passage, 3 questions with answer choices) follows the layout presented in figure 3. There is a maximum of 20 lines available on the screen display for a passage and a question. Therefore, text portions should be limited to 15 lines and each question and answer segment should not exceed 5 lines.

Note the "flags" that are included in the test item (e.g., *, *3303,)). These are essential for correct processing of the test items by the DX System.

To view, input and revise test items, follow these steps -

1. Insert diskettes A and B as before and turn on computer.
2. Type X for execute.
3. Remove diskette B from drive #2 and insert diskette C.
4. When asked, "Execute what file?" type #5: EDITTEST and press RETURN.
5. A menu of 4 choices is displayed. Insert the letter of your choice and press RETURN.

Sample text showing test item layout
Reading Comprehension Test

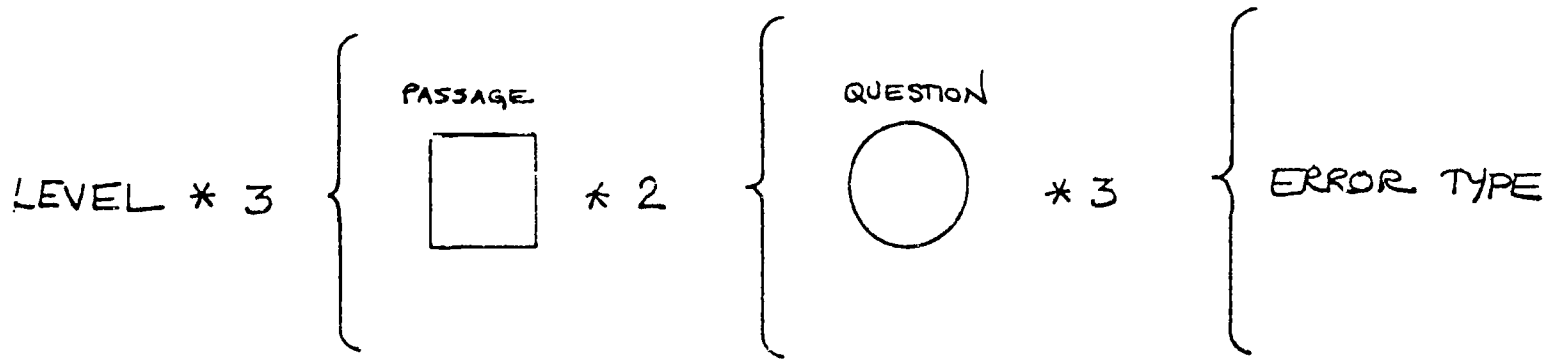
There are many active volcanoes on earth such as the famous Mauna Loa in Hawaii. They occasionally shoot smoke and lava onto the earth's surface. The formation of a volcano can be thought of as an underground balloon buried under thin layers of sand and plaster. Hot magma fills the balloon, and pushes up the ground. Magma is the hot material that forms the earth's center core. The magma pushes upward inside the volcano and melts the surrounding rock and dirt. The melted rock and dirt is called lava. Eventually, the lava will push through the top of the mountain. This action causes a volcanic explosion and forms a crater. After the explosion, or eruption, the lava cools off and the mountain sides shrink somewhat. This is similar to a balloon shrinking after it pops. A volcano is said to be inactive when it no longer produces eruptions.

- * ←
- This passage is mostly about how...
- a. volcanos are filled with lava. Flag: end of Item text
 b. mountains are sometimes volcanoes.
 c. volcanoes are created.
 d. magma creates mountains. Flag: end of Question text
plus response markers
(i.e. Error types:
"a" = 3
"b" = 3
"c" = correct response
"d" = 3)
- *3303 ←
- An active volcano...
- a. erupts every other month.
 b. erupts occasionally.
 c. never erupts.
 d. contains cold lava.
- *2022
- According to the passage, when a balloon pops, its sides...
- a. shrink.
 b. become larger.
 c. crack.
 d. become rounder.

- *0111
) ← Flag: end of last item
- (Butterflies are created through an interesting series of stages. Adult butterflies lay their eggs on leaves or tree branches. These eggs turn into caterpillars. The caterpillars crawl around the trees and bushes, feeding on leaves. Eventually, the caterpillars weave themselves a silken shell called a cocoon. The caterpillars sleep inside the cocoon for a few weeks. Inside the cocoon, the caterpillar grows its butterfly wings, antennae and body. When it awakens, the butterfly breaks out of its cocoon and flies away. When it lays eggs, the process will begin again.
- *
 The passage is mostly about how...
 a. adult butterflies are made

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Figure 2



13

EXAMPLE

higher difficulty
 moderate difficulty
 lower difficulty

There are very active volc
 surface. The formation of
 buried under layers of san

This passage is mostly
 a. volcanoes are fille
 b. mountains are sonet
 c. volcanoes are creat
 d. magma creates mount

*3303

TOTALS

3

6

18

3

17

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18

6. If Writing new test items you will be asked to name the test file and use either an Existing file or entry from the Keyboard. Then you will enter prepared test items, following the sample format provided above.
 7. If making Changes or Reviewing existing tests, you will need to identify the test file to be used. Type the test file to be used. Type the test name as it appears on the catalog and the test will be displayed.
 8. When multiple tests are to be used, make multiple copies of diskette B. It is recommended that each test go on a different copy of diskette B, so sufficient storage room is available for test results files. Be sure to label diskette carefully.
- C. Procedures for test administration are demonstrated in section IV. Prior to following those procedures, consider these preparatory steps -

- 1 - make additional test diskettes, as the storage capacity for test results files is limited;
- 2 - have complete directions and sample items for students;
- 3 - plan a routine and a schedule for the testing session, allowing sufficient time for each student to take the test in one sitting;

Sample test performance summaries

Performance summary for D.MACA: pronoun test

Out of 11 items attempted . 3 items were correct
27 % correct overall
33 % correct at highest level attempted (2)
20 % correct at lowest level attempted (1)

This student made ----
3 errors in using nominative pronoun.
 An example of this is Item # 17
2 errors in using direct object pronoun.
 An example of this is Item # 11
3 errors in using pronoun as object of preposition.
 An example of this is Item # 16

Performance summary for D.MACA: comprehension test

Out of 6 items attempted , 5 items were correct
83 % correct overall
0 % correct at highest level attempted (3)
100 % correct at lowest level attempted (2)

This student made ----
A single error in literal comprehension of a sentence.
 It occurred in Item # 1

Performance summary for M.BACCUS: pronoun test

Out of 12 items attempted , 9 items were correct
75 % correct overall
66 % correct at highest level attempted (2)
83 % correct at lowest level attempted (1)

This student made ----
A single error in using nominative pronoun.
 It occurred in Item # 10
A single error in using direct object pronoun.
 It occurred in Item # 7
A single error in using pronoun as object of preposition.
 It occurred in Item # 16

Performance summary for M.BACCUS: comprehension test

Out of 7 items attempted . 5 items were correct
71 % correct overall
100 % correct at highest level attempted (3)
66 % correct at lowest level attempted (2)

This student made ----
A single error in identifying the main idea.

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D. Summary of test results can be retrieved any time after the testing session. When summaries are no longer needed, files can be deleted to allow room for new test results files. However, if re-testing is desired, up to four files can be stored using the same filename (i.e., for the same student).

E. Tests in the DX System can be used for diagnosis prior to instruction and also for post-testing, if desired. Errors identified by the system provide information for instructional planning and determination of student master:

The preceding figure shows diagrammatically the flow of test materials administered to several hypothetical students. The first student, whose path is shown as a bold line, gives a correct response to every question. While diagnostically uninteresting, from the point of view of the DX system her route through the various test items is responsive to her performance, as follows:

- Entry is made to a passage of middle difficulty, with its first question [# III 1].

- Regardless of response, the sequence continues through three additional items, [# III 2, III 3, and IV 1].

- Because she has totalled four correct within this level at this juncture, she is next presented a passage from a high level of difficulty [# I 1].

- Regardless of response, the sequence continues through three additional items, [# I 2, I 3, and II 1].

- Because she has totalled four correct within this level at this juncture (and there are no higher levels to administer) she exits from the test.

The second case, shown by a solid line is of a student who fails every question presented. Again diagnostically uninteresting, nonetheless his passage through the test is governed by his performance. His opening sequence is identical for four items, until:

- Because he has four wrong responses after # IV 1, he is next presented with a passage from a lower level of difficulty [# V 1].

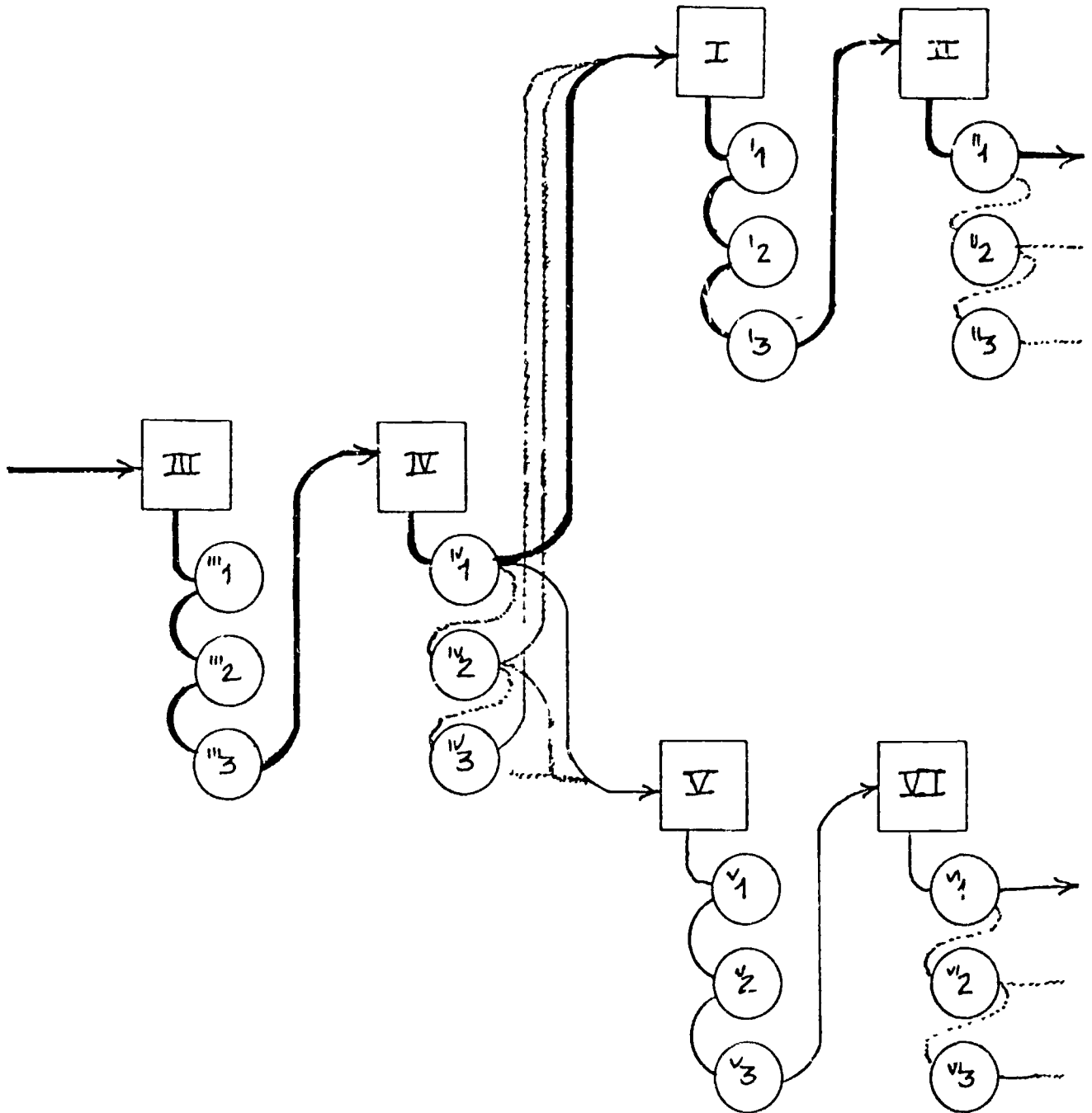
- Regardless of response, the sequence continues through three additional items, [# V 2, V 3, and VI 1].

- Because he has totalled four wrong within this level at this juncture (and there are no lower levels to administer) he exits from the test.

The dotted lines show additional moves made by students with less clear-cut patterns of response. That is, some but not all answers are correct. Now diagnostically interesting, the patterns such students take through the system are evaluatable within the context of both the level of the item at which their errors occurred, and the type of error which was made. This latter component is found in the error coding attached to each question, of which the system keeps track during the test to tabulate relative frequencies of error types.

APPENDIX

Flow of Test Item Presentation



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