

Differential Effectiveness of Programmed Instruction

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In August, 1963, our staff initiated research into the control of alcohol consumption by men who had been diagnosed as alcoholics.² The application of programmed instructional technology was considered for two reasons. First, the professional staff was critically concerned that the voluntary patients be accurately and thoroughly informed about the possible effects of the drug which they might use to assist them in the control of their drinking before they indicated their acceptance of this treatment. Second, the staff was also concerned about the utilization of professional manpower, and the programming effort was viewed as immediately costly but economical over the long-range.

A prior publication had reported the relationship between readability and programmed information, (Grace, 1963). The current study was designed to test the effectiveness of different conditions of presentation upon the immediate understanding of the information in the program.³

Procedurally, the prospective patient is carefully screened by the professional staff after he has been medically approved for treatment. If he is considered suitable for the alcohol control project, he is given the programmed information to study. After he studies the program, he is tested. If he makes any errors on the test, the staff explains his mistakes to the patient. If the staff is satisfied that the patient understands the drug and its possible effects on him, the patient may sign a formal release which indicates his willingness to use the drug. The patient then returns to his physician who prescribes the drug and supervises his taking it. All patients are volunteers. The signing of a release is standard procedure. The drug is not experimental, although the design of the research project calls for the drug to be used as one treatment modality.

Brochures about the drug, research reports on its effects, and expert medical opinion were sources for the authenticity of the information which was programmed. The information was programmed linearly with a constructed response required for each frame, allowing the patient to check his answer immediately by uncovering the correct answer which was under a slide. The program was tried on samples of men until it became operational in the third edition.⁴

Four manners of presentation, with identical wording and frame sequences, were developed from the third edition. First, each frame required a constructed response with immediate access to the correct answer by uncovering that answer (CR-IMMEDIATE). Second, each frame required a constructed response with optional access to the correct answer which was listed on a sheet at the rear of the program (CR-OPTIONAL). Third, each frame required a constructed response without access to any correct answer (CR-WITHOUT). Fourth, in the narrative condition, each frame was written as a complete sentence (NARRATIVE).

Each of these four manners of presentation was administered in two modes: logically, as programmed; and scrambled, the four legal-length pages randomized. (These four conditions are preceded by an "X" in the paragraphs which follow).

Subjects were selected from the same institutional population, but neither alcoholics nor men who had previously studied the program were considered in the analysis of the data. Twenty subjects were solicited for each of the eight conditions and assigned at random to each condition.⁵ Neither intelligence nor prior experience with programming were factors. In the analysis of the data, subjects who failed to answer a complete test page were also eliminated. The t

test was the statistical measure used in analysis of the data.

When considering the number of patients who made any error of omission or commission, CR-WITHOUT is significantly more effective than any other condition, .01 level. NARRATIVE is significantly more effective than CR-OPTIONAL, .05 level; and XCR-IMMEDIATE is also more effective than CR-OPTIONAL, .01 level. Finally, XCR-IMMEDIATE is more effective than X-NARRATIVE, .01 level. No other comparisons between conditions approach significance.

Considering the infrequency of item errors of omission or commission, CR-WITHOUT is significantly more effective than any other condition, .01 level. X-NARRATIVE is significantly less effective than the following remaining conditions: NARRATIVE and CR-IMMEDIATE, .01 level; and XCR-IMMEDIATE and XCR-OPTIONAL, .05 level. CR-OPTIONAL is significantly less effective than the following remaining conditions, .01 level: NARRATIVE, CR-IMMEDIATE and XCR-IMMEDIATE, XCR-OPTIONAL, and XCR-WITHOUT.

In discussion of these results, we find that the Air Force reportedly applies a criterion of 90% of the personnel responding correctly to 90% of the items, or an overall criterion of 81% person-item correctness. (P.I., 1964-64). Applying this criterion, the eight conditions rank in descending order of effectiveness as follows: 96%, CR-WITHOUT; 89%, XCR-IMMEDIATE; 86%, NARRATIVE; 85%, CR-IMMEDIATE and XCR-OPTIONAL; 84%, XCR-WITHOUT; 81% X-NARRATIVE; and 78%, CR-OPTIONAL.

This study was designed to examine the effectiveness of logical presentation and of optional answers in programmed information. The results are not conclusive. Only one condition, CR-OPTIONAL, fell below the Air Force criterion

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of 81% person-item correctness. This criterion may not, however, be applicable to the field of health. We should probably accept no less than 99% as a criterion, and then only if there must be a face-to-face professional follow-up of patients who fail to respond perfectly.

CR-WITHOUT is an outstandingly effective condition of presentation of this information for this population. The 96% errorless criterion performance of these non-alcoholic patients compares favorably with the 97% performance of alcoholic patients who used the third edition. We infer that the constructed response program without answers interests the patient intrinsically, motivates him, becomes "functionally autonomous" for him, appeals to his curiosity, or does not bore him by superfluous redundancy.

This study also raises methodological questions about research into the knowledge of results (KOR). Four dimensions are suggested as a test for the effects of KOR: first, response triviality or criticality, frequently mentioned in the programming literature; second, answers in isolation or in context; third, answer immediacy versus answer delay; fourth, answer informational value or redundancy.

Answers are customarily isolated after a frame has been completed by the subject. They may be presented at the side of a page, on a following page, preceded by a brief remark of "yes" or "no", but answers are usually out of context. Thus the subject may become as answer-conditioned by studying a program as he

may become from short-answer tests. Some effectiveness of CR-WITHOUT may be attributable to the answer's being in the context of the following frames.

Placed as they usually are in programs, answers tend to be more immediately accessible than delayed upon completion of a frame. There may be some "cerebral" benefit to delay in answer accessibility. The OPTIONAL conditions which we tested proved to be poor, but they were not the worst conditions, even though patients had to flip to the rear of the program if they chose to check their answers. The best condition, CR-WITHOUT, provided greater delay in answer accessibility than did the CR-IMMEDIATE conditions.

Redundancy is often bi-modal in its effects on communication (Grace, 1956). In the study we reported earlier, programming presented simpler words more often than did narrative text. Perhaps words may be repeated too often, as in an answer which is again repeated in the following frame, thus contributing to boring redundancy and negative feedback effects.

The KOR problem may be clarified by research directed toward the effectiveness of programs for which answer meaningfulness, context, immediacy, and redundancy operate as independent dichotomies or variables.

Programming offers the field of health the opportunity to present information effectively and economically, as measured by the utilization of professional manpower and by improved patient care

and treatment. The linear method of programming information about a drug, which this study of 150 male patients demonstrated to be most effective, required a constructed response to each frame, without the patient's being informed of the correctness of his written response by means of some display of the correct answer.

FOOTNOTES

- 1.—Dr. Grace is Chief, Research Laboratory for Applied Behavioral Sciences, Psychology Service, Veterans Administration Center Domiciliary, Los Angeles, and Post Doctoral Scholar, School of Public Health, U.C.L.A. Dr. Cantor is Coordinator, Program for Alcoholic Rehabilitation Psychology Service, Veterans Administration Center Domiciliary, Los Angeles.
- 2.—J. A. Waites, Ph.D., Veterans Administration Center Domiciliary, Los Angeles, "An Investigation of Differential Control Procedures for Alcoholic Members in a Domiciliary Setting."
- 3.—H. A. Grace and Joel M. Cantor, "Differential Effects of Program Presentation."
- 4.—Programmers were M. H. Bloom, UCLA, and R. L. Furedy, UCLA and University of Southern California, Student Summer Employees, Veterans Administration Center Domiciliary, Los Angeles.
- 5.—P. Ebersole, M.A., UCLA, Psychology Trainee, Veterans Administration Center Domiciliary, Los Angeles, administered the program and the test to the patients.

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