

# Research Abstracts

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## *Abstracts from ERIC*<sup>1</sup>

### Restructuring Information

"Error Patterns in Problem Solving Formulations," George Kennedy, John Eliot, and Gilbert Krulee, *Psychology in the Schools*, 1970, 7, 1, pp. 93-99.

This study sought to determine how students process information given to them in algebraic word problems and if there are differences in the ways in which able and less able students formulate word problems. Specifically, two hypotheses were tested: 1) that the difference between less and more able students is a function of their ability to restructure information given them; and 2) that students who are unable to solve algebraic word problems formulate the problems sequentially as facts appear, and consequently tend to choose a solution pattern based on information given early in the problem statement.

To test the first hypothesis, problem solving was defined in terms of five steps, three of which required restructuring of information. Two of these restructurings—that of mathematical interpretation of problem elements and the identification of relationships among elements—involve a rather direct translation from words into symbols. The data indicate that the two groups of students *do not* differ in their ability to carry out these two types of restructurings, but *do* differ in their ability to add and to identify inferences about logical or physical assumptions.

The rationale for the second hypothesis was that the successful students will first try to understand the problem, and that the ability to understand does not depend upon a sequential processing of the information. This hypothesis was partially confirmed by the data. Results

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are interpreted as suggesting that teachers should be less concerned with teaching students to define the relationships between problem elements and more concerned with helping them to identify the logical and physical assumptions made in the problem statement. Further, the results are seen as providing useful guidelines for computer programmers interested in designing on-line programs capable of "conversing" with poor algebra students one way and with able students in a different way.

Programed  
Instruction:  
*Sequencing*      *Research and Theory on the Effects of Instructional Sequencing*,  
Gerald L. Natkin, Bucknell University, 27 pp., 1970.

Although previous research has indicated no significant relationship between sequencing of programed instructional materials and terminal achievement, it is felt that certain conditions might produce such a relationship. In order to test this idea, a hierarchy of word meanings was constructed in which each definition was dependent on the previous one. The hierarchy was divided into several different linear and scrambled versions according to the amount of memory and information reorganization required to learn the material, and the linear and scrambled versions were then administered to two groups of 80 high school students.

Factorial analysis of results showed a significant difference in achievement between students using the linear version and those using a scrambled version for the lower degrees of memory requirement. However, there was no difference in achievement at the higher levels of memory requirement (when more than nine concepts had to be remembered). Conclusions were that sequence does have an effect in programed instruction when a certain optimal memory load is not exceeded, and that further research should be done on the learning mechanisms involved in programed instruction.

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Feedback in Two  
Models of Verbal  
Learning      *Feedback and Sentence Learning*, John T. Guthrie, Johns Hopkins  
University, 36 pp., 1970.

The theoretical functions of external feedback in stimulus-response and closed-loop models of verbal learning are presented. Contradictory predictions from the models are tested with a three-by-three factorial experiment including three types of feedback and three amounts of rehearsal. There were 90 adult students run individually and they were required to learn 39 sentences verbatim.

The results were: 1) feedback facilitated learning when it followed wrong responses, 2) feedback had no effect on learning following right responses, and 3) feedback consisting of both the stimulus and the response was superior to "no feedback" whereas feedback consisting of only the response did not differ from "no feedback." The findings are discussed in relation to the two learning models and programed instruction.

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**Auto-Instruction:** *Testing the Effectiveness of Auto-Instruction in a Paired Learning Arrangement*, Gary L. Awkerman, Charleston County School District, North Charleston, S.C., 19 pp., 1970 (A paper presented at the American Educational Research Association convention).

It is possible that the student himself may be a valuable resource in the individualization of instruction in the elementary school. This study paired a fourth grade student with a sixth grade student who had similar reading skill levels. The pair then used a kit of auto-instructional materials designed to teach elementary school science. Students at a control school received conventional instruction in science.

The study showed that fourth and sixth grade students can learn from autoinstructional materials without teacher assistance. There was no difference between the experimental and control groups in achievement levels or self-concept scores. Neither sex, reading level, nor race affected achievement. Only social position affected achievement significantly.<sup>2</sup>

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**Programed Instruction:** *The Relationship of Anxiety, Response Mode, and Content Difficulty to Achievement in Programed Instruction, Final Report*, Sigmund Tobias and Theodore Abramson, City University of New York, New York City College, 40 pp., 1970.

To establish an attribute-by-treatment interaction between anxiety, stress, and response mode to programed instruction, a research design was used which consisted of two experimentally manipulated variables—stress and response mode—and two variables assigned on the basis of test score—the facilitating and debilitating anxiety scores of the Achievement Anxiety Test.

A total of 144 college students were randomly assigned to a stress or nonstress group, and to one of three response modes: constructed response with and without reinforcement, or to a reading group. The

<sup>2</sup> See article by James Hartley in this issue of AVCR (p. 133).

learning materials consisted of a linear program dealing with the area of heart disease. The program contained material both familiar and unfamiliar to students. Posttests on both types of content were administered immediately after the program, and the data were analyzed by multiple linear regression.

A strong positive relationship between facilitating anxiety and achievement on the technical program was found. Facilitating anxiety also interacted with stress and response mode for technical material. Debilitating anxiety failed to interact with any of the variables for technical material, though an interaction with stress for familiar materials was found.

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Programed  
Instruction:  
Response Mode  
and Other  
Variables

*The Interactive Effect of Responses per Frame, Response Mode, and Response Confirmation on Intraframe S-R Association Strength, Final Report, Charles Karis and others, Northeastern University, 85 pp., 1970.*

To investigate the role of response mode, confirmation procedure, and frame content variables in linear self-instructional programs, a 384-frame medical terminology program was developed, tested, and validated. The program was then administered during periods of four consecutive days to 450 freshman students who were randomly assigned to a group using one of 18 versions of the program. Criterion measures consisted of four daily unit tests, a postprogram comprehensive test, and a delayed retention test; items in each test required either the reproduction of medical terms or the definition of medical terms.

Findings from both daily and comprehensive tests showed that overt response was superior to covert response and that reading response was definitely a function of the reproduction accuracy required on criterion items for reproduction of medical terms. Also, while variations in frame size resulted in no significant difference, the variation of number of responses required per frame produced a significant effect in favor of multiple responses when test items required medical term responses.

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Programed  
Instruction:  
Step Size

*"Chunking Method of Determining Size of Step in Programmed Instruction," James M. Furukawa, Journal of Educational Psychology, 1970, 61, 3, pp. 247-254.*

This study was an attempt to obtain maximal subject achievement by matching programed-instruction step size with learning ability on the subject. One hundred ten female, undergraduate subjects, of high or low scores on a test of short-term memory, learned Hawaiian words in

a 1-, 2-, 7-, 14-, or 21-chunk programed-instruction step size. (One "chunk" consisted of one sentence containing the item to be learned.)

Smaller steps led to significantly higher performance for all subjects *within* the programed instruction; however, posttests showed 7 and 14 chunks to be best with 7 probably being better for subjects with low short-term memory scores. The findings are seen as strongly suggesting that programed instruction need not be limited to single sentences or paragraphs.

Programed  
Instruction:  
*Definitional vs.  
Conceptual  
Learning*

*Definitional Versus Conceptual Learning, Final Report*, Robert L. Swinth, University of Kansas, 16 pp., 1970.

The basic tenet of programed instruction (PI), that learning occurs best when knowledge is imparted in small increments, appears to apply to associative rather than deductive processes. One may best learn definitions via association, and best learn inferences via unified understandings. This hypothesis was tested by structuring two modes of presentation for a topic in economics, a PI package, and a text. Two subject groups each received one of the presentations.

No differences were noted between group performances. While the hypothesis that subjects learning by the text approach would do better on inferential questions and subjects learning by PI would do better on definitions was not confirmed, sex differences were noted. Males performed better using the text while females did better using PI. All subjects performed poorly on inferential questions indicating that people must be specifically and explicitly taught deductive reasoning. (The latter was not done in the text used in this study.)

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Manipulanda vs.  
Pictures

"Objects Versus Pictures in the Instruction of Young Children," Geraldine M. Devor and Carolyn Stern, *Journal of School Psychology*, 1970, 8, 2, pp. 77-81.

A popularly held assumption that young children learn more effectively when they can manipulate real objects than when the same concepts are presented pictorially was tested in an experiment with 36 four-year-old children in the Los Angeles Children's Centers. A supplementary question was whether these young children could learn concepts and vocabulary concerned with the home environment in a replicable instructional program.

All the children were pretested and assigned on a stratified random basis to one of three treatments. One group received training with three-dimensional manipulanda, a second group received exactly the same program except that the instructional materials were line drawings, in color, of the three-dimensional objects, and a third group served as a control.

On the posttest, both experimental groups were significantly superior to the control group. Contrary to expectation, however, no significant difference attributable to the types of materials used for instruction was found. The only difference between the two instructional procedures was that the program with manipulanda tended to take more time.

**Structural Coherence**     *Structural Coherence in Verbal and Pictorial Displays*, Ronald W. Spangenberg, National Education Association, 19 pp., 1970 (A paper presented at DAVI—now Association for Educational Communications and Technology—Convention).

Structural coherence (SC) and discriminability were the two variables in this study of information displays. Discriminability refers to the obvious differences between words and pictures; SC is the degree to which elements of a display appear as integrated. The study presented the items to be learned in verbal or pictorial form, with the degree of SC varied from minimal to moderate to overall.

Initial learning of displays showing overall SC provided significant improvement in learning a transfer task, as did initial learning of pictorial displays. Illustrative figures supplement the report.

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**Visual Learning:  
No Sex, Age  
Differences**     *Visual Learning: An Analysis by Sex and Grade Level*, Francis M. Dwyer, Jr., Pennsylvania State University, 49 pp., 1970.

The study investigated 1) whether boys and girls in the same grade level learn equally well from the same types of illustration, and 2) whether identical illustrations are equally effective for boys and girls in the same grade level on tests designed to measure student achievement of different educational objectives. The study showed no significant differences between boys and girls in the ninth through twelfth grades with regard to learning from visual illustrations.

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**Color and Codability**     *A Study of Color in Instructional Materials and Its Effects Upon Learning, Final Report*, Don L. Tolliver, Purdue University, 96 pp., 1970.

This study examined the extent to which college students were affected by and remembered color information within instructional materials. Factors studied were color codability, verbal cueing, type of question, stimulus silhouettes, and prompting. These factors were included

in stimulus scenes for study via two 16mm motion picture films. Color silhouettes, included in the films, were presented for testing. Subjects responded to color names in one film and to color patches in the other. High- and low-codable colored stimuli were included with the simple object and geometric shape silhouettes. Half the items asked color questions while the other half asked position questions.

Results indicated that: higher scores were achieved with high-codable colored stimuli than with low; color names were not always easier to remember than color patches; and higher scores were achieved with position items than with color items and with simple object stimuli rather than with geometric shape stimuli. Differences appear to exist between colors as they interact in instructional materials.

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Television: *Attention Factors in Televised Messages: Effects on Looking Behavior and Recall*, Sherilyn Kay Ziegler, Michigan State University, 122 pp., 1969.

The study sought answers to the following questions: 1) given the same visual content in televised messages, how are looking behavior and recall affected by varying camera techniques? 2) given the same visual content, how are looking behavior and recall affected by relevant and irrelevant audio? 3) how are looking behavior, recall, and content evaluations affected by simple and complex displays of the same visual content?

An eye-movement camera was equipped with a 16mm reflex motion picture camera to record eye movements across televised messages. Three message manipulations were employed: 1) visual hesitation (operationalized as "blank spaces" appearing between series of items on the screen), 2) audio-video interlock (operationalized as visual presentation of items and simultaneous verbal mention of them), and 3) visual simplicity and complexity (operationalized as symmetrical and nonsymmetrical arrangements of a given set of items). Subjects were 48 undergraduates.

The manipulations had almost no significant effects on looking behavior or retention, although many of the effects observed were in the predicted directions. It was recommended that all three manipulations be studied in connection with subjects' tendency to *follow the action* occurring on the screen and with their inclination to *anticipate* information not yet exposed visually. The eye camera apparatus has just begun to be used in the area of televised messages.<sup>3</sup> This study concluded that it may provide a useful tool in communication research, as more attention factors are identified and isolated.

<sup>3</sup> See Guba et al., "Eye Movements and TV Viewing in Children," *AV Communication Review*, 1964, 12, 386-401.

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**Visuals:** *The Effects of Visual Angle, Brightness, and Contrast on the Visibility of Projected Material*, Richard Maddox Metcalf, Indiana University, 77 pp., 1968.

*Image Size, Brightness, and Contrast*

A study was conducted with three eighth-grade students to determine the separate and joint effects of image size, image brightness, and image contrast on the visibility of projected materials. Twenty-five hundred slides were presented, representing 20 slides each of all possible combinations of values of the independent variables. Telegraph keys were wired to a timer and used to indicate both the accuracy and speed of the subject's response.

Results showed that both visual angle and contrast affected both reaction time and the number of correct responses. It was concluded that: 1) letter size should subtend a minimum of 16.32 minutes of visual angle for adequate visibility, 2) if the room cannot be sufficiently darkened, materials must be increased in size for adequate visibility, and 3) for materials of a minimum size, contrast must be relatively high to obtain adequate visibility.

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**Feedback:** *The Development of Clinical Skills in Speech Pathology by Audiotape and Videotape Self-Confrontation, Final Report*, Daniel R. Boone and Ernest L. Stech, University of Colorado, 95 pp., 1970.

*Videotape vs. Audiotape*

An initial study with 30 students in clinical speech pathology training found videotape confrontation to be a powerful clinical training technique. This subsequent study, using 20 additional students, was designed to compare the effectiveness of audiotape and videotape, and to ascertain whether videotape self-confrontation increased self-awareness and insights into use of operant methodologies. The study also evaluated a previously developed therapy analysis matrix as a tool in evaluating audiotape confrontation.

The results of the investigation suggest 1) that both audiotape and videotape are effective procedures for training speech therapists, 2) that audiotape confrontation when combined with behavioral scoring is as effective as videotape confrontation in changing verbal behavior, and 3) that the therapy analysis matrix appears to be a useful tool in evaluating the taped therapy sessions.

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Feedback: *Video-tape With and Without Delay*

*The Effects of Television and Expert Feedback on Self-Perception*, David R. Peters and Philip J. Schreiner, University of California at Los Angeles, 27 pp., 1970 (A paper presented at Western Psychological Association).

This field experiment investigated the effects of confronting people with different types and timings of descriptive feedback on their presentations of self. The experimental subjects were 28 male graduate students who made three-minute informal presentations on a personal topic and then received feedback on their individual performances. Feedback types and sequences were 1) TV videotape replay, 2) expert description, and then delayed TV, and 3) no immediate feedback (control) followed by delayed TV.

Semantic differential instruments, developed to assess the visual and vocal self, were administered before, during, and one week after the experiment. The results indicate that 1) immediate TV feedback had a stronger effect upon the structures of the self-percepts than did expert feedback or no feedback, but the differential effects were not always significant, 2) subjects in all three group-conditions first shifted significantly toward self-attitudes which were more favorable, 3) both types of change were greater for subjects with less speaking ability, and 4) the revised self-assessments were not altered further by any delayed TV feedback and were maintained over a follow-up period of one week.

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Feedback: *Effect of Videotape on Anxiety*

*Effect of Videotape Playback and Teacher Comment on Anxiety During Subsequent Task Performance*, Myles P. Breen and Roderick Diehl, 7 pp., 1970. (A paper presented at DAVI—now Association for Educational Communications and Technology—Convention.)

Feedback by teacher comment, by television playback, and by self-analysis, singly, or together, reduced anxiety in subsequent performance as measured by nonfluencies in speech. Nonfluencies were counted in eight categories: the sounds "ah," "um," or "uh;" correction; sentence incompleteness; repetition; stutter; intruding incoherent sound; tongue slip; and omission. Performance in six treatment groups ranged from a low of 10.4 nonfluencies after there was videotape recording, teacher comment, and playback to a high of 37.1 nonfluencies after there was no videotape recording, no comment, and no playback.

Since videotape playback without teacher comment resulted in almost double the nonfluencies (21.3) of those resulting from videotape playback with teacher comment, the conclusion was reached that a positive interaction between the two practices is to be desired. It is

interesting that the mere presence of a television camera and recorder reduced nonfluencies somewhat, perhaps because of Hawthorne effect.

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Vocal Behavior and  
Automated Analysis  
of Emotional States

*Analysis of Vocal Behavior, Final Report*, John A. Starkweather, School of Medicine, University of California, San Francisco, 76 pp., 1969.

This investigation sought 1) to develop acoustic measures of the voice to monitor the behavioral and emotional state of a speaker using a voice communication channel, 2) to develop computer programs for pattern recognition of complex acoustic data to enable rapid processing, feedback of results, and adjustment of parameters for further work, and 3) to investigate the feasibility of equipment for the assessment of the behavioral state of personnel located at remote locations. A spectrum analyzer was developed to obtain time-averaged acoustic spectra of continuous speech which was converted into digital form for data reduction and analysis by off-line computer. The approach can be used to identify individual speakers from a pool of known speakers, and to discriminate between different states (such as drugged and normal) of one speaker.—*Available from National Technical Information Service, Springfield, Va. 22151, microfiche 65¢, hardcopy \$3.00, as document AD-698 142.*

Videotape vs.  
Audiotape  
Feedback

*An Experimental Study of the Relative Pedagogical Effectiveness of Videotape and Audiotape Playback of Student Speeches for Self-Analysis in a Basic Speech Course, Final Report*, Anthony John Mulac, Eastern Michigan University, 238 pp., 1968.

To test the relative instructional values of videotape and audiotape playback in Eastern Michigan University's fundamentals of speech program, the following general hypothesis was established: the greater the completeness and accuracy of student speech performance feedback, the greater the speech skill a student will later exhibit. Feedback was defined as any consequence or result of performance that is perceived by the learner. Behaviorally, there were three levels of feedback: 1) videotape replay of two class performances with traditional (class and instructor) feedback for all performances, 2) audiotape replay of two class performances with traditional feedback for all performances, and 3) no electronic replay of any class performances but with traditional feedback for all performances. Native speech skill and improvement were measured by nine evaluators who viewed videotapes of the first and final speeches made by all students. Analysis indicated that subjects who

viewed videotapes of two of their class performances demonstrated significantly greater improvement in speech skills than did the other students. There were no significant differences between the audio-tape and the "no-tape" groups of students.—*Microfiche 65c, hard-copy \$9.87, document ED 032 760.*

Knowledge of  
Correct Responses  
and Ability Level

"The Effects of Two Methods of Teaching Social Studies on Immediate Retention," Joan K. Oliver and Bob L. Taylor, *The Journal of Educational Research*, January 1970, 63, 5, pp. 198-200.

The effect on immediate retention of two methods of teaching social studies was investigated. With one method, immediately after students responded they were informed of the correct response. With the other method, students were given no knowledge of the correct response. Twenty-three matched pairs of accelerated eighth-graders and 19 pairs of slow eighth-graders served as subjects. They were matched on age, sex, level of ability, and score on a social studies achievement test. Provision of knowledge of correct response had no significant effect on the retention scores of the accelerated students, but significantly raised the scores of the other students.