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ABSTRACT

Certain aspects of the performance of adults on verbal reasoning tasks were studied. The four main objectives of the study were: to develop a self-instructional booklet for use in teaching adults the functional rules of classification; to construct a reliable instrument for use in assessing the capability of adults to perform verbal classification tasks; to study the influence of four different factors of content on the difficulty of the tasks to be performed on each item of CAT; and to use both demographic variables and primary ability test scores to predict performance of the adult participants on CAT. Results of the study, utilizing 30 adults in an experimental group and 30 in a control group, indicate that experienced-based instructional strategies should be preferred in the teaching of logical skills to adults. Appendix I presents the Structure of Classifying; Appendix II is the structure of the Analysis of Learning Components for Verbal Classification Tasks; and Appendix III is a Sample Page from Self-Instructional Program in Verbal Classification. References are provided. (Author/DB)

AN EXPERIMENT IN DEVELOPING THE ABILITY OF DISADVANTAGED ADULT LEARNERS TO PERFORM VERBAL LOGICAL OPERATIONS

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The improvement of the student's ability to think and reason by himself has traditionally been seen by some educators as one of the fundamental outcomes of instruction in the school. In the field of Adult Education, program objectives stressing the acquisition of rational and judgmental skills by the adult have often been stated. [1]. The present study focused on certain aspects of the performance of adults on verbal reasoning tasks.

Objectives of the Study

The study had four main objectives. The first one was to develop a self-instructional booklet to be used in teaching adults the functional rules of one common verbal logical operation, namely classification. This booklet was 72 pages long and used a Programmed Instruction branching format.

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The second objective, was to construct a reliable instrument to be used in assessing the capability of adults of performing verbal classification tasks. This test, the Classification Assessment Test, comprised 32 items and will be referred to in this paper as CAT.

The third objective of the research, was to study the influence of four different factors of content on the difficulty of the tasks to be performed on each item of CAT. These factors were: D, an index of the logical complexity of each item; F, an index of word difficulty; N, the total number of words used, per item; and S, the "sign" of the classification operation, that is, whether the operation assigned a particular object to a class or whether it denied class membership.

Lastly, the fourth objective of the study was to use both demographic variables and primary ability test scores to predict performance of the adult participants on CAT. Demographic variables included age, level of education, and time spent at the Vocational Training Center which the participants were attending at the time of the experiment. Assessment of primary abilities included three tests from French's kit [2], namely "Figure Classification," measuring non-verbal induction, "Letter Span-Auditory", measuring immediate memory span and "Vocabulary" measuring familiarity with words.

Rationale

The general assumption underlying the study is that verbal communication of a subject matter via instruction has a logical structure

which must be processed and understood by the learner if learning is to take place. To the logical structure in the subject matter, then corresponds a hypothetical and similar organization of the learner's cognition. This assumption can be traced back to several works both in the field of psychology and the field of education.

In the field of psychology the notion of logical patterns implicitely followed by individuals in their processing of verbal information can be related to Stewart's notion of "validity patterns", as introduced in his theory of communications. [3]. His main assumption is that "the verbal communication of ideas is a function of the isometry of validity patterns existent in the minds of those involved in the communicative process". [4].

In other words, the processing of verbal information whose content is framed into certain logical patterns is a function of the individual's capability of performing the corresponding logical operations. The results of the present research provide evidence for both the existence of such logical patterns and the use of logical rules in the processing of verbal content by individuals.

A second area of reference in experimental psychology is what Ash has called the "psychology of relations", [5], more specifically applied to verbal learning. This approach is exemplified in the recent work of Frase concerning the processes involved in learning from written instructional materials. One of his major ideas to which I subscribed in this research is that "learning from written instructional material is a consequence of establishing relations among pairs of text items." [6].

In the context of the present research it was assumed that processing of the logical organization of a text consisted of the establishment of logical relations among certain linguistic items of the text. No attempt was made, however, to verify this assumption by studying, experimentally, the processes involved.

In the field of education Gage has reviewed what he calls a "cognitive approach to learning and teaching" which implies that "maximum advantage should be taken of the cognitive properties of learners and subjects". [7]. In the present research, the logical organization of the subject matter was focused on, as one of its most central "cognitive properties". More specifically, the analysis of the logical organization was made using a set of categories developed by Smith at the University of Illinois. [8]. Smith, empirically identified different categories of logical operations, such as explaining or defining, into which the verbal content of the discourse of high school classes could be classified. These operations have a fixed structure of relationships among their components, and it is possible to formulate for each of them, a set of "epistemic rules", that is, a set of logical rules concerning the correctness of the operation, including its validity and truth. [9].

Smith's study was purely analytical and descriptive in nature, "one in the natural history sense." [10]. It was, also, purely logical. At the end of his study, however, Smith was raising, among others, the following question, a psychological one in nature: "Is the student better able to monitor his own thinking as well as that of others if he has

knowledge of the logical structure and rules governing the performance of these operations?" [11]. The present research is precisely an attempt at answering this question. Thus, participants were provided with the structure and the rules governing the performance of verbal classifications and it was hoped that as a result, they will improve their performance on CAT.

Procedures

The instrument used to assess the subjects' capability of performing verbal classificatory tasks, CAT, was a 32 item test with multiple choice format. The structure of each item on the test followed the same model. It was made of three propositions: a claim, a warrant, and some facts. One sample of CAT items appears in Appendix I. The claim is a proposition stating that a particular object belongs to a category, or on the contrary, does not belong to the category. The warrant is a proposition stating the kind of criteria by which to decide whether an object belongs to a given category. And, finally, the facts are characteristics of the object which, in terms of the criteria, indicate that the object should be placed in the particular category. On the test, the subject was given warrant and claim, and he was asked to select the correct facts from four possible alternatives.

A pool of forty original items was generated using verbal content from encyclopedias, textbooks, newspapers, and magazines. A

particular effort was made at selecting content related to the adults' immediate experience of his physical and social environment. References to local names and familiar realities were included.

Thirty-two items were finally selected and sometimes modified, so that they would fit the characteristics specified for each level of the four factors of content, D, F, N, and S. Thus, there were sixteen different types of items and two replications of the same type.

Prior to the writing of the training program, a behavioral analysis of verbal classificatory tasks was made, in order to determine what were the competencies that needed to be mastered before the subject could be able to perform the final task. This analysis yielded a structure of learning tasks which became the basis for writing and sequencing the components of the training program. Such a structure is presented in Appendix II. Eight subordinate skills were then taught in the training program prior to the mastery of the final capability. Practice in performing tasks similar to those of CAT (Classification Assessment Test) items was finally provided through three exercises. The participants studied the instructional program for two and one-half hours.

A group of thirty adults currently enrolled in the Canadian Manpower Training Programs was selected as the experimental group and a group of equal size was used as the control group. Both experimental and control groups were given CAT pre- and post-tests along with the ability tests. The instructional program was given only to the experimental group. (See Appendix III for sample page of Training Program).

Results and Conclusions

In regard to the effect of the training program on performance on CAT, the comparison of post-test scores adjusted for scores on the pre-test did not show any significant difference between experimental group and control group (mean score for experimental group was 23.01; it was 23.34 for the control group).

This lack of effectiveness may be explained by several reasons. First of all, the training program might teach the right skills that are required to perform well on CAT but it might not be long enough to reall develop those skills on a permanent and transferable basis. In other words, logical or reasoning skills can be improved only through a long-term type of instructional program which provides enough presentations of the same stimuli and enough reinforcements of the same correct responses.

Another reason for the failure of the training program might have been that the performance of adults on logical tasks involves other skills of a different nature than mere cognitive skills or mere knowledge of the rules of a classification operation. It might involve, for instance, the ability to behave according to a rule or the ability to behave according to a goal that one has set. Or, it might involve such personal characteristics as consistency of behavior in similar situations. Those skills are of a more global nature and involve both cognitive and affective domains.

This has implication, of course, for the type of instructional strategy that is most suitable for the development of logical skills. Perhaps, in the case of the adult, only experience-based methods would give him the opportunity to change his approach to logical tasks on a broad behavioral scale. Such methods have been used extensively, for instance in industry, in the form of problem-solving sessions and simulation exercises. [12].

The existence of a significant practice effect for both groups from pre- to post-test, tends to give some confirmation to the above hypothesis concerning the superiority of an "Activity Method" [13], in adult learning. In this case, performance was improved as a result of practicing on the test, rather than through learning the rules and how to apply them.

An internal consistency measure of reliability of CAT yielded a satisfactory coefficient of 0.884, thus showing that CAT is a relatively homogeneous test measuring consistently the same type of capability. Its relationship to established measures of reasoning ability and of verbal comprehension must be further investigated.

To study prediction of performance on CAT, experimental and control groups scores were gather into one group (N = 71). Age was the best predictor of performance on CAT ($rr = -0.485$) with Grade Level as the second best predictor (Age and Grade Level in the step-wise regression equation explained 30.3 percent of the variance in CAT scores). Age and Grade Level were both significant ($p > .95$) predictors.

The correlation of CAT and the variable "time already spent in attendance at the vocational school" was practically null *(r = 0.086)*. This tends to show that the school does not teach reasoning skills through its curriculum. Letter Span-Auditory measuring immediate memory span showed the greatest correlation with CAT among the three ability tests, *(r = 0.227)*.

The relationship between demographic variables and reference factor tests included a significant correlation of -0.279, between Age and Figure Classification measuring a factor of non-verbal induction. This result tends to confirm previous findings, that the ability to induce rules and try hypotheses does decline with age [14]. A positive correlation between Age and Vocabulary, previously reported by some investigators, appeared here also, and reached a significant high of 0.414 ($\rho > .95$).

None of the factors of content, believed to influence the difficulty level of CAT items, reached significance level. However, the difference in mean scores was in the expected direction for all four factors. The difference was especially large for factors D and N. In the case of factor D, representing an index of logical complexity, a high level of factor D yielded an average score of 1.187, whereas, a low level of the same factor produced an average score of 1.295. The result gives empirical evidence, of the existence of a logical structure in verbal materials and it gives some validity to the index used to quantify this dimension, in the present study.

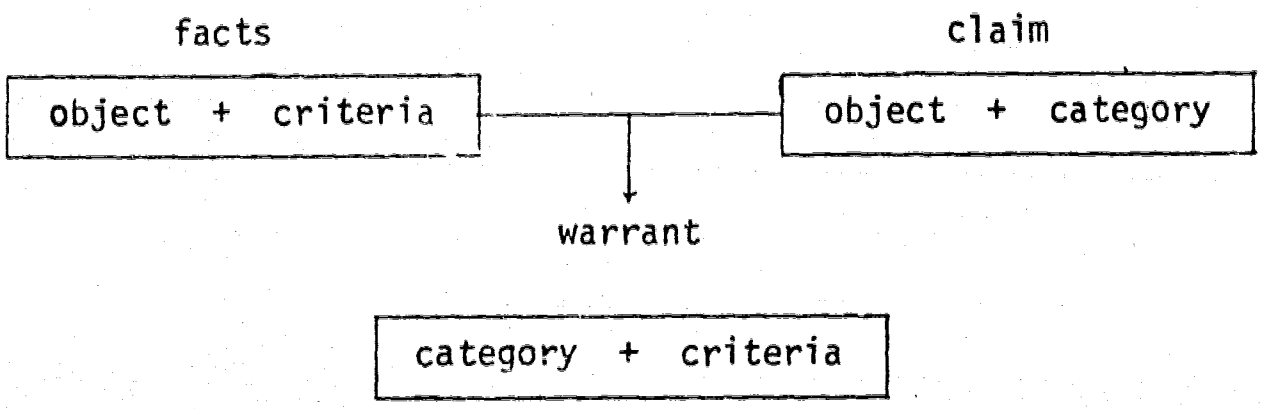
In the same manner, a greater number of words used in CAT items (factor N) produced an average score lower than in the case of a smaller number (1.107 against 1.376).

Summary

Verbal communication of a subject matter via instruction has a logical structure which must be processed and understood by the learner if learning is to take place. The present study was an attempt at teaching adults the rules of one of the logical operations performed by the learner in the classroom, namely classification. Results tend to indicate that experienced-based instructional strategies should be preferred in the teaching of logical skills to adults.

APPENDIX I

STRUCTURE OF CLASSIFYING

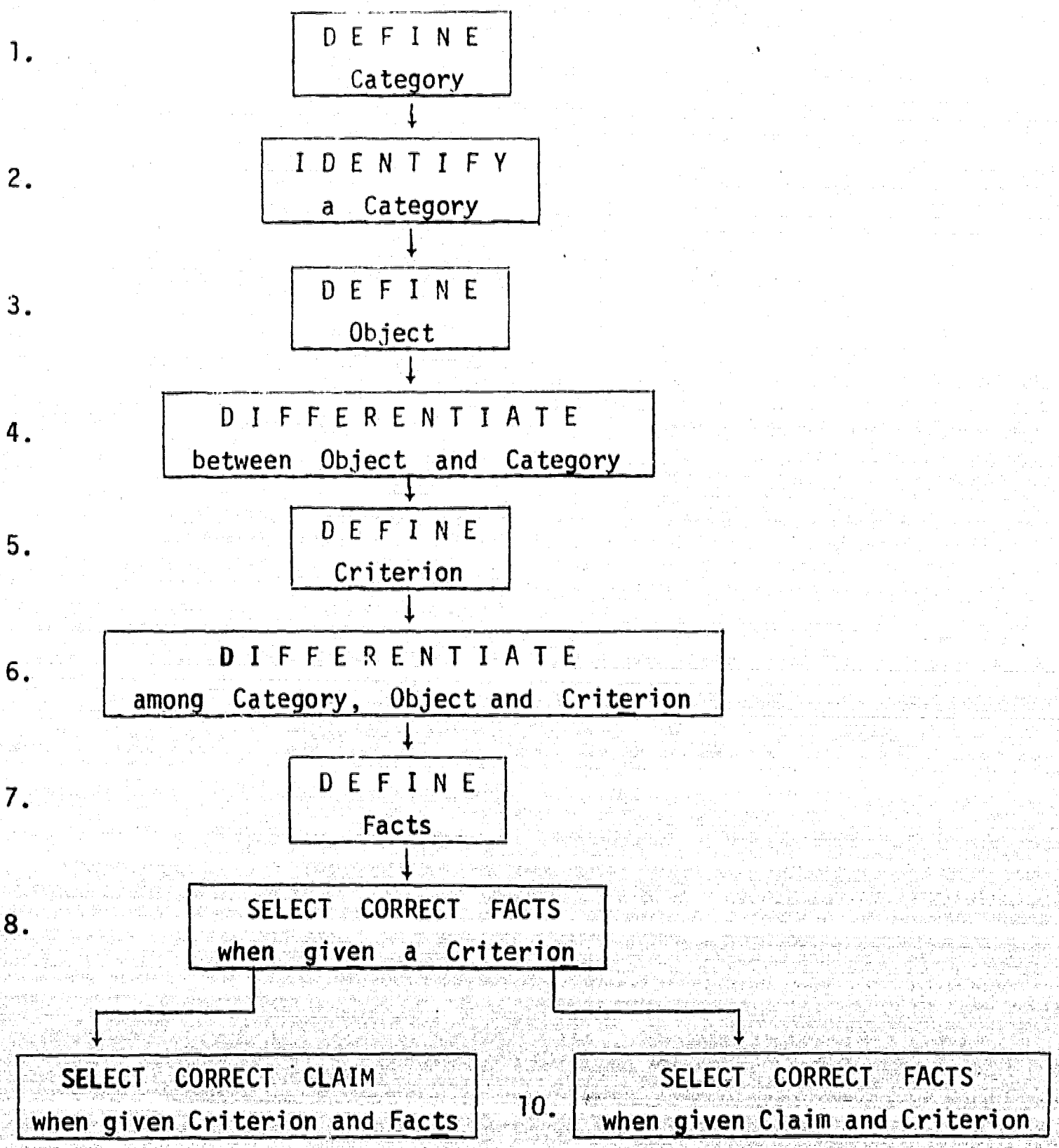


EXAMPLE OF A CLASSIFYING OPERATION

Claim:	
Object (A. B. MacDonald) + Category (Citizen of Canada)	"A. B. MacDonald is a citizen of Canada."
Warrant:	
Category (citizen of Canada) + Criteria (born in Canada)	"Everyone born in Canada will be a citizen of that country."
Facts:	
Object (A. B. MacDonald + Criteria (born in Canada)	"A. B. MacDonald was born in Nova Scotia in 1935 and Nova Scotia is one of the provinces of Canada."

APPENDIX II

ANALYSIS OF LEARNING COMPONENTS FOR VERBAL CLASSIFICATION TASKS



APPENDIX III

SAMPLE PAGE
FROM SELF - INSTRUCTIONAL PROGRAM
IN VERBAL CLASSIFICATION

Page 29

(from page 30)

6.3.	By now you should be able to differentiate an object from a category.

If I say:

"The Volkswagen is one of the European cars imported to Canada," in this case the object is "The Volkswagen".

Which one is the category? (Select one).

1.	THE VOLKSWAGEN	RETURN TO PAGE 28
2.	EUROPEAN CARS	TURN TO PAGE 36
3.	CANADA	TURN TO PAGE 32

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