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ABSTRACT

Ninety children in third and fourth grade were assessed on a hierarchical class inclusion task. Scores were trichotomized, and children from each level were randomly assigned to one of three cueing conditions (no cues, two superordinate cues, six subordinate cues). Subjects were administered a recall task of categorized words and "new" words (paralogs). Significant effects for classification level and cueing condition were found for total recall on trial one, and for classification level, cueing condition, and their interaction, on trial four. Recall of paralogs on trial five was a function of classification level only. This study suggests that classification skills mediate both acquisition and recall of categorized words. (Author/AA)

CLASSIFICATION SKILLS AND CUEING CONDITIONS IN FREE RECALL OF FAMILIAR AND NEW WORDS AMONG 3RD AND 4TH GRADE CHILDREN

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CLASSIFICATION SKILLS AND CUEING CONDITIONS IN FREE RECALL OF FAMILIAR AND NEW WORDS AMONG 3RD AND 4TH GRADE CHILDREN

Much research attests to the age-related increase in the ability of children to recall experimenter/presented pictures and/or words. The effect on recall of such variables as category clustering and cueing has also been demonstrated to be age-related. Some recent research (Grippin, Brody, and O'Connor, Note 1, Tomlinson-Keasey, Crawford & Miser, 1975) has related these developmental phenomenon to classification operations described by Inhelder and Piaget (1964).

Research on the effect the semantic feature taxonomic category, on free recall indicates that word lists containing several examples of a few different categories will be recalled better than a list of unrelated words. Mandler (1967) suggested that subjects who discover the categories in the list use this information to reorganize the verbal material for storage and retrieval. He further hypothesized that if the verbal material could be hierarchically organized, a greater quantity of verbal material could be stored and retrieved. The hierarchy could be used as a plan in which category cues were recursively used from the top to the bottom of the hierarchy. However, children often respond as if they are not aware of the categories inherent in a list. A frequently used experimental manipulation is to provide subjects with category cues. Bower, et. al. (1969) reported that if the cues are hierarchical, beginning with super-ordinate cues and proceeding to subordinate cues, the hierarchical relationships within a list will be discovered.

According to Piagetian investigators the development of classification skills is one manifestation of the emergence of concrete operations and is observed through the child's ability to hierarchically include related classes of objects in ascending and descending order. Inhelder and Piaget (1964) report that class inclusion tasks which include a hierarchical ordering of abstract concepts (those not experienced or acted upon in daily living) require greater reliance on linguistic concepts which must be created during the execution of the task. The concrete operation of class inclusion varies with the character of the content being classified. When the critical defining attributes of a class are well known by the child, examples fall easily into classes and class inclusion is exhibited. However, when the intension of the classes is not clearly known by the child, the classification system breaks down. Rather than using the class inclusion structures utilized with more familiar content, the child falls back on earlier schemes for classifying, such as juxtaposition.

The above would suggest that facilitation of recall by category cues might depend upon the level of abstraction of the cues in interaction with the developmental level of the child. Children with immature classification skills would benefit more from subordinate cues than superordinate cues because the critical defining attributes would be better known. For children with mature classification skills, differences as a result of level of abstraction of cues should not be as great, since the critical defining attributes of both subordinate and superordinate categories would be familiar. The classification operation is hypothesized to serve the

function of organizing incoming stimuli for storage and facilitating retrieval at a later time.

Tomlinson-Keasey, Crawford & Miser (1975), using Piagetian-type class inclusion tasks, selected equal numbers of classifiers and non-classifiers from among kindergarten and first grade children. These children were then randomly assigned to either a free or cued-recall condition and shown slides of familiar objects. They found no differences in total recall as a function of cueing, but classifiers recalled significantly more pictures than non-classifiers.

Grippin, Brody and O'Connor (Note 1) assessed 125 fifth graders on a hierarchical class inclusion task which required the children to subsume chickens in the class of birds, distinguish birds from other winged animals (e.g. insects) and subsume all winged animals under the superordinate "animals." Scores were trichotomized and children from each level were randomly assigned to one of three category cueing conditions (no cues, 6 subordinate cues, 2 superordinate cues). Subjects were then group administered a free recall task of conceptually categorized words and paralogs. Significant effects for recall of words were found for classification level, cueing conditions, trials, and cueing by trials. Although children of all classification levels recalled more words in the 6 subordinate cue condition, the children in the highest classification level clearly outrecalled other children in all three cueing conditions.

The present study sought to extend this reaearch to third and fourth grade children and to include analysis of acquisition and recall of new "words" (paralogs) as a function of classification level and cueing condition.

The hypotheses of the study were:

(1) Children with more mature classification capabilities will recall more words and paralogs than children with less mature capabilities.

(2) Cueing condition will significantly affect recall of words and paralogs with six subordinate cues facilitating recall more than 2 superordinate cues or no cues.

(3) Children with more mature classification capabilities will be less affected by cueing condition than children with less mature capabilities.

Method

Ninety children in grades 3 and 4 were individually interviewed and assessed on the hierarchical class inclusion task described above which was modified from one described by Inhelder and Piaget (1964, p. 111). The task consisted of seven yes-no questions and a justification response for each. Points were assigned for both response and justification in accordance with Table 1. Subjects were trichotomized by number of points scored on the classification task. There were no differences between grade 3 and grade 4 in proportion of children at each classification leval, $x^2(2) = 2.38$, $p > .10$.

Insert Table 1 about here

Subjects were randomly assigned to one of three cueing conditions in the free recall task. The recall task consisted of 30 words which were blocked according to conceptual category (animal: 4 legged, fish, bird; plant: fruit,

vegetable, flower) with four words and one paralog per category. Categories were chosen from Battig and Montague (1969) frequency norms which represent the frequency of association to superordinate label by college students. Within each category, the four highest frequency words were chosen which could yieldcorresponding high frequency values in the Rinsland (1945) frequency counts and the Lorge-Thorndike frequency for elementary school age children. The paralogs were chosen from the Locascio and Ley (1972) scaled-rated list to have low, equivalent meaningfulness. The word lists were group administered via slide-projector over 5 trials. Experimenter read each word/paralog when it appeared on the screen. Presentation order was counterbalanced both with respect to category sequence and item-sequences within categories, except that each paralog was always placed in the middle of its category sequence. Items were projected on the screen at 2 second intervals. Intertrial writing time was 3 minutes. Treatment was operationalized by answer booklets to each child. Each booklet asked the subject to write down all the new and old words he/she could remember after each of the first 4 trials. Condition one had no other information, condition two had the two superordinate cue words (plants, animals), condition three had the six subordinate cue words. Following trial five, all subjects were instructed to write down all the "new" words (paralogs) he/she could remember and each booklet contained the two superordinate cue words.

Results

Separate 3 (classification level) x 3 (cueing condition) unweighted means $ANOVA_s$ were performed for total recall on trial one, trial four, and trial five.

Results for trial one were consistent with the previously reported fifth

grade data. (Grippin, Brody and O'Connor, Note 1). Classification level was significant, $F(2,81) = 11.05$, $p < .001$. Cueing condition was significant, $F(2,81) = 7.20$, $p \leq .001$. The interaction term was not significant.

For trial four, classification level was significant, $F(2,80) = 10.12$, $p < .001$. Cueing condition was significant, $F(2,80) = 7.30$, $p < .001$, and the interaction effect was significant at $p < .10$, $F(4,80) = 2.43$.

Examination of the cue means for the trial four interaction using the protected-t procedure (Wilkowitz, Ewen and Cohen, 1976), and $p < .01$ revealed that cue condition had no effect on classification level 3 Ss, those children with the most mature capability. The only other non-significant comparison was between classification level 3Ss and classification level 2Ss in the six subordinate cue conditions (See Figure 1).

Insert Figure 1 about here

Results for trial five, recall of "new" words (paralogs) reveal significant effects for classification level. Comparisons of cue means for classification levels on trial 5 using the protected-t procedure yielded significant differences between all pairs of means ($\bar{X}_1 = 1.74$; $\bar{X}_2 = 2.27$; $\bar{X}_3 = 4.17$), $p < .001$. Cueing conditions over trials one through four made no difference in number of paralogs recalled on trial five and there was no interaction effect.

While recall of familiar words was mediated by both classification level and cueing conditions, acquisition and recall of new words (paralogs) were a function of classification level alone.

Discussion

The hypotheses of this study were supported by the data. Children with more mature classification skills did recall more words and paralogs than children with less mature skills. Cueing condition did significantly affect recall. Six subordinate cues were more facilitative than two superordinate or no cues. Children at classification level 3 were not only less affected by cueing condition, but not affected at all.

This study, in conjunction with the studies discussed previously, leads to some speculation regarding the development of organizing operations for memory and the function of external organizers. Kindergarten and first grade children demonstrated no facilitation of recall by category cues, but classification skill was significant (Tomlinson-Keasey, Crawford & Miser, 1975). Third, fourth and fifth graders benefited from category cues, but those children with highest classification scores were unaffected by cueing condition and had superior recall in all cueing conditions. Children who were in the mid-level of classification skill had higher recall than the lowest level children in no-cue and six subordinate cue conditions, but dropped below lower level children in the two superordinate cues condition suggesting that the abstract cues interfered with their recall strategies. Finally, acquisition and recall of paralogs among the 3rd and 4th graders was related only to their classification skills. If further research is supportive of these findings, it would appear that classification skills are basic to organizing memory and facilitating recall. The use of external organizers (category cues) may facilitate recall by directing the search (Williams and Goulet, 1975), but the benefits of such cues do not appear to be far-reaching.

If these inferences are accurate, elementary school children would benefit much more from activities involving building ascending and descending hierarchical classes than from use of external category cues or instruction in the use of category cues to organize data. This, of course, is consistent with the theoretical view that mental structures are self-constructed through interaction with the environment and mediate learning (Piaget, 1964).

Reference Notes

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Table 1

Scoring System For The Piaget Classification Protocols

Response	Justification	Points
1. Incorrect	incorrect	0
2. Correct	incorrect or no justification	1
3. Correct	correct, but not a full explanation	2
4. Correct	correct and full explanation	3

Note: An example of a 2 and 3 point response follows:

Q - Can one put the winged animals in with the birds and call them all birds?

2 points No, the winged animals don't lay eggs

3 points No, because insects are not birds

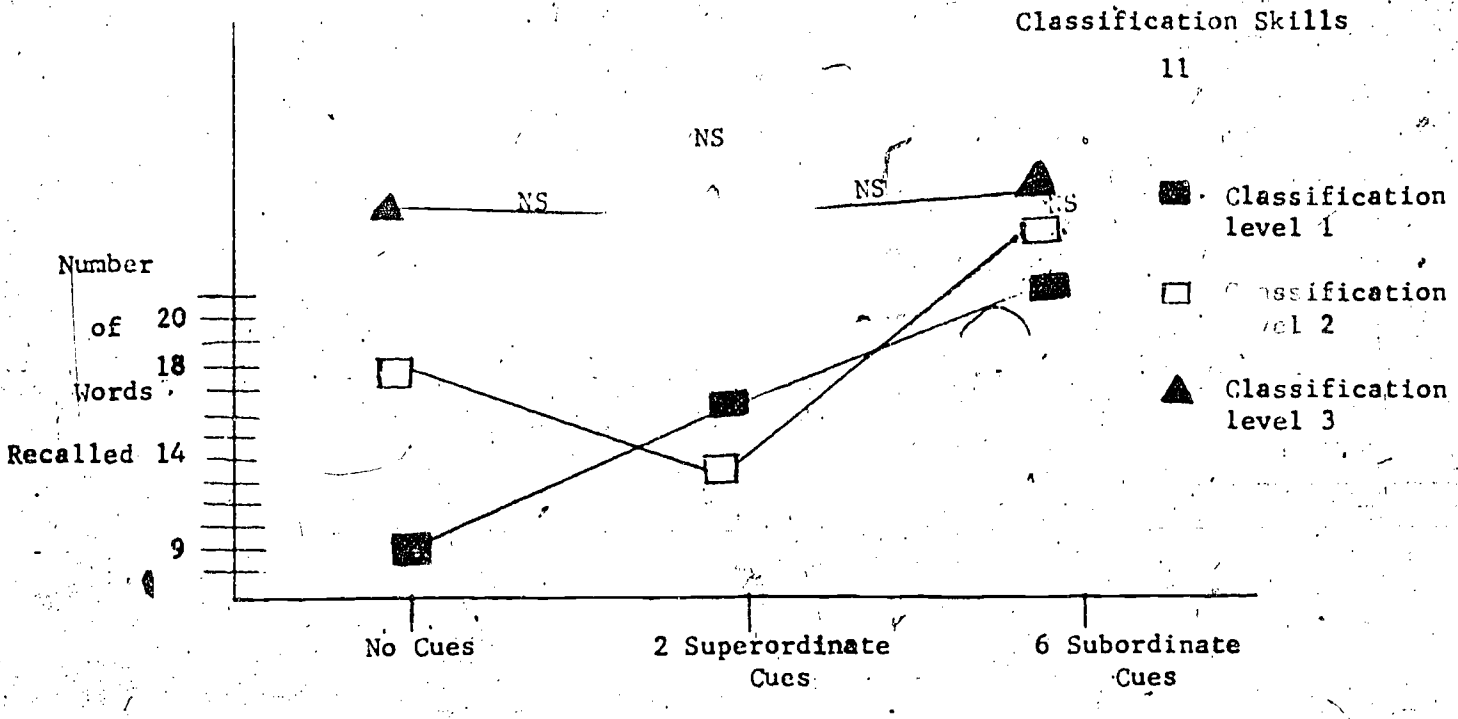

Figure 1. Interaction effect for number of words recalled on Trial 4 as a function of treatment condition and classification level. All comparisons except those marked NS were significantly different.