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RECENT RESEARCH IN VISUAL DISCRIMINATION--IMPLICATIONS FOR BEGINNING READING.

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AN OVERVIEW OF THE RESEARCH ON VISUAL DISCRIMINATION SHOWS A TREND FROM THE WHOLE-WORD VIEW TO A COMBINATION OF LETTER-DISCRIMINATION AND THE WHOLE-WORD METHOD. TEN STUDIES CITED IN THIS ARTICLE ATTEMPTED TO ANSWER THE FOLLOWING QUESTIONS--(1) WOULD NONVERBAL STIMULI FACILITATE READING PERFORMANCE; (2) DO CHILDREN FOCUS ON THE SHAPE OF THE WORD OR ON INDIVIDUAL LETTERS WITHIN THE WORD, (3) IS TRAINING WITH WHOLE WORDS MORE EFFECTIVE THAN TRAINING WITH ISOLATED LETTERS, (4) WHAT SKILLS TRANSFER FROM THESE TWO TYPES OF TRAINING, (5) WHAT IS THE MOST EFFECTIVE COMBINATION OF CUES FOR HELPING CHILDREN LEARN SIGHT WORDS, AND (6) DOES KNOWLEDGE OF LETTER NAMES AFFECT LETTER-DISCRIMINATION TRAINING. SOME IMPLICATIONS FOR BEGINNING READING INSTRUCTION BASED ON THIS REVIEW OF RECENT RESEARCH SUGGEST (1) THAT TRAINING IN VISUAL DISCRIMINATION SHOULD BEGIN WITH WORD AND LETTER STIMULI RATHER THAN WITH NONVERBAL GRAPHIC STIMULI, (2) THAT THE EARLIEST VISUAL DISCRIMINATION EXERCISE IN KINDERGARTEN SHOULD USE LETTER STIMULI, AND (3) THAT VISUAL DISCRIMINATION TRAINING SHOULD INCLUDE EXERCISES IN ASSOCIATING SOUND AND MEANING WITH VISUAL FORM. WHILE THESE IMPLICATIONS ARE BASED ON THE RESULTS OF EXPERIMENTS, UNCONTROLLED CLASSROOM STUDIES WOULD SHOW WHETHER OR NOT THEY ARE FEASIBLE. THIS PAPER WAS PRESENTED AT THE INTERNATIONAL READING ASSOCIATION CONFERENCE (SEATTLE, MAY 4-6, 1967). (NS)

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# RECENT RESEARCH IN VISUAL DISCRIMINATION: IMPLICATIONS FOR BEGINNING READING

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## Introduction

Many systems of beginning reading instruction use the so-called "sight-word" approach to introduce children to their first reading material. The children are presented with a basic set of words which they learn to read. Later these words provide the basis for formal instruction in word analysis skills including structural and phonic analyses.

Learning sight words is an association process. As such, certain general factors are known to affect the ease with which the

association is learned. First, the responses to be learned must be available and readily discriminated from one another. Secondly, the stimuli to be associated with the responses must be discriminated so that recognition is consistent for each appearance of the same stimulus.

In teaching reading, we have been well aware of the importance of making reading responses readily available. This has been done by selecting beginning reading words that are of high frequency in children's speech. Unless children have culturally disadvantaged or culturally different backgrounds these words are available; at most, we need to provide some auditory discrimination training to sharpen discriminations among similar sounding words.

The stimuli or printed words in beginning reading present a different problem entirely. In the beginning these graphic patterns are not readily discriminable, or consistently recognized. Assuming the beginning reader has the spoken responses available, he is faced with two learning tasks with respect to these graphic patterns. First, he must learn to discriminate among the visual symbols; second, he must learn to associate each of the graphic patterns with an appropriate spoken word.

The present paper is concerned with the kinds of training that are most effective in helping children learn to discriminate among graphic patterns. Our purposes are two fold: 1) to present an overview of the research bearing on this question of discrimination learning and 2) to suggest implications for teaching which seem warranted on the basis of this research. We say, "suggest implications" advisedly, since the majority of the research cited will be experimental in nature. This

means that it was carried out in highly controlled and artificial circumstances. For this approach we make no apology. This step in educational research is imperative in order to assess, unambiguously, the operation of certain factors in the learning process. However, this type of research can only be a beginning. Experimental research needs to be followed up with classroom studies to determine whether or not the manipulations and variables which produce significant effects in experimental situations will also produce differences in the classroom that are practically as well as statistically significant.

## Historical Development

Before we look at the recent research in discrimination learning, it would be useful to review briefly the history relating to the question of how children see words, particularly, why whole words have been considered the child's "natural" unit of perception (14). Several sources have contributed to this thinking. American educators writing in the 1850's opined (4) that words are more easily remembered than letters because they are not such minute objects and because they are more meaningful. At the turn of the century, Huey (6) cited evidence from tachistoscopic research using adult subjects indicating that word "form" was the critical cue for perception. In 1922, Buswell's (1) studies of eye movements showed that the mature reader seemed to organize his reading perceptions by words and even phrases. Although the data from tachistoscopic and eye movement research could be used to support the "whole-word view," these same studies also showed that as the reading material became more difficult, or when young and inexperienced readers were used

as subjects, discrimination of words proceeded mostly on a letter-by-letter basis. The historical clincher for the "whole word" approach, however, appears to be psychological theory, not experimental evidence. In 1924, Max Wertheimer, the Gestalt psychologist, (3) stated that the whole is greater than the sum of its parts, and that the form or grouping that is most natural is the one which involves the smallest interval. Since words are letter groupings set apart spatially from other words, this theory seemed to provide the answer to word perception.

## Recent Research

What does more recent research say about how children learn to discriminate visually among words? Our research with prereaders takes its beginning where Goins left off (5). Goins' study was the first that made a systematic attempt to train first grade children in visual discrimination. That her tachistoscopic training with non-verbal type visual stimuli did not facilitate reading performance suggested the need for visual discrimination training with stimuli that are immediately relevant to learning to read; namely, printed words and letters themselves. Our first study (11), confirmed the specificity of transfer in the area of reading (Table 1). Three groups were given visual discrimination training or matching practice with three types of material: words that appeared on a subsequent reading task, words that did not appear on the subsequent reading task, and geometric forms. The results on the reading test favored the first group that had practiced discriminating among the same words that appeared on the reading task. Since there was no difference between

the geometric and different word group, the results indicated that what is learned in discrimination is very specific and that this learning transfers only when the words in the reading task are highly similar to those in discrimination training. These results raised the question: What specifically are the children attending to as they learn to discriminate among words? Is it the "form" or shape of the word as a whole, or is it individual letters within the word? A study designed to assess these factors (12) showed two interesting findings (Table 2). First, word shape or form did not seem to be an important cue to kindergarten children in discriminating among words. Specific letter differences between the words seemed to be the significant cue. Second, although discriminating letters in isolation was much easier than discriminating letters embedded in words, the isolated letter group did just as well on the reading test as did the groups that had discriminated the letters in the words. A similar study by Staats, Staats, and Schutz (15), however, failed to confirm these findings. They found that visual discrimination training using the whole words was more effective than training with the letters in isolation. Professor King's doctoral dissertation (7) attempted to resolve these conflicting findings. Her study design is shown in Table 3. It is important to note the difference between the visual discrimination training group with different meaningful words and the other groups. In this group, the children saw a picture of the word when the word was first presented and, in addition, the word was pronounced. The results showed two groups clearly superior in their word reading performance: the different meaningful word group and the relevant letter matching

groups. In visual discrimination training, the letter matching task was the easiest of all; the different meaningful word most difficult. What skills transferred from these two different types of training? The different meaningful word group presumably learned that it is appropriate to respond to printed stimuli with meaningful responses, which after all is reading. By contrast the letter group apparently learned to attend to the visual features that provided a basis for discriminating among the words. A subsequent study by the Cornell group (9) indicated that training with the letter at the beginning of a word is relatively more effective than with letters that occur in other positions. Another factor we attempted to assess was the relative effectiveness of presenting the materials in the matching tasks either simultaneously or successively (7). Table 4 shows the difference in these two approaches. In the top example, the matching stimulus is presented at the same time as the response choices; in the bottom example, the matching stimulus is presented first and then removed before the response choices are presented. We found no reliable differences between these two methods of matching as measured in performance on the reading task.

Positive transfer to reading resulting from associating a meaningful picture with a word in visual discrimination training led to the question: What is the most effective combination of cues for helping children learn sight words? The study designed to answer this question (8) is shown in Table 5. Children were asked to learn to read two lists of words. In one list, the words were highly similar in sound and appearance; in the other list, highly dissimilar in sound and appearance. The same table also shows the different combination of

cues that were used in teaching the words to different groups of children. In each group the printed word was always presented. In addition, the words were accompanied by one or more additional cues. For example, in groups three and four, the printed word was accompanied by the teacher's saying it and the child repeating it. In groups nine and ten, the word was accompanied by cues provided by a picture, the teacher's saying the word, and the child's saying it. After each of the four words and accompanying cues were presented to the various groups, a test trial was given using the word alone, with the child trying to recall the correct response. The results at the end of the learning session are shown in Table 6. They indicate that when words were highly similar, additional cues helped the child discriminate and recall the printed word and sound association. Thus, groups 1-4 were reliably better in performance than the group that just heard the teacher say the word. For the dissimilar word groups, just the opposite order resulted. Hearing the word alone provided the best learning condition while the picture cue provided the least effect method. Since it is likely that most printed words appear more similar than different to the beginning reader, it would seem safe to conclude that the use of pictures and other accompanying cues will be helpful in mastering sight vocabulary.

One final area of our research remains for summary. The question can be asked: If training in discriminating among letters facilitates word discrimination and reading, what effect does knowledge of the letter-names have on this process? The results of a study just completed are shown in Table 7 (13). The columns represent above and below the median

groups based on the Harrison-Stroud letter-naming subtest administered in September of first grade. The rows represent extreme reading groups matched in IQ based on end-of-first grade year Metropolitan reading test performance. Letter-naming ability appears to be markedly associated with later reading success. No child below the 50th percentile in letter-naming ability was in the high reading group. Twice as many children above the 50th percentile appeared in the high as compared to the low reading group. These results support Durrell's (2) earlier findings. We are not certain whether this relationship indicates that training in the knowledge of letter-names would facilitate word discrimination and reading, or whether knowledge of letter-names is an indication of a basic ability to form associations between abstract visual stimuli and auditory sequences. Durrell's methods study involving teaching letter-names and sounds supports the training notion.

## Implications for Teaching

Keeping in mind that we are now moving from controlled experimental situations to the classroom, the results from this experimentation appear to have made some practical implications for the classroom teacher.

1) Visual discrimination training from the very beginning should be with word and letter stimuli. Having the child match animal pictures, geometric forms, or any kind of non-verbal graphic stimuli does not appear to transfer to word discrimination. Our data confirms a point of view expressed by McKee (10) almost 20 years ago.

2) The simultaneous matching format which exists in most pre-reading books and charts at the present time seems adequate. To date

we have found that simultaneous matching is easier than successive matching and that the transfer of discrimination learning appears to be about as effective.

3) Since matching letters is an easy task for kindergarten children, the earliest visual discrimination exercises should use letter stimuli. Although we do not as yet know how knowledge of letter-names works in the discrimination and reading process, the evidence strongly indicates that teaching the letter-names is probably highly useful. Letter discrimination and naming can be taught simultaneously.

4) Just prior to beginning reading instruction, visual discrimination exercises should include training in making the "three-way association" of the sound and the meaning with the visual form. If words are accompanied by a representative picture (when possible) and the pronunciation of the word then a child gradually learns to attach a meaningful verbal label to the printed word each time it is encountered in a matching exercise. Such training provides not only for skill in visual discrimination but also skill in responding to graphic symbols in a manner similar to that required in learning to read.

5) Since the transfer of visual discrimination training seems to be very specific, the teacher would do well to give children practice in discriminating among the new words to be learned at the beginning of a reading lesson. At this point, a successive presentation could be used in the discrimination training. This type of presentation demands greater attention to the words in order to recall their letter characteristics since the word is not in view when the choices are presented.

6) When presenting new vocabulary words, particularly words that

are easily confused with other words because of sound and letter similarities, providing additional cues in the form of pictures, when possible, and having the children pronounce the words will probably facilitate learning.

If the above research has answered a few questions, it has raised many more. Much investigation needs to be done in the future. We hope to continue our efforts.

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Table 1

TYPE OF TASK AND ORDER

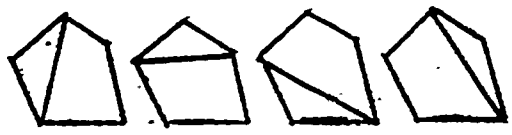
| First | | Second |
|---|---|---|
| Visual Discrimination Training (Matching) | | Reading Words |
| Groups | Materials | All groups |
| Same | boat, help, play, come | boat<br>help |
| Different | make, jump, work, find | play<br>come |
| Control |  | |

Table 2

TYPE OF TASK AND ORDER

| First | | Second |
|---|---|---|
| Visual Discrimination Training (Matching) | | Reading Words |
| Groups | Materials | All groups |
| Same form | feu, geu, reu | feu - "blue" |
| Different form | fjd, gjd, rjd | geu - "red" |
| Letters only | f, g, r | reu - "white" |

Table 3

TYPE OF TASK AND ORDER

| First | | Second |
|---|---|---|
| Visual Discrimination Training (Matching) | | Reading Words |
| Groups | Materials | All groups |
| Different word (meaningful) |  nest, cake, ring, duck | hand |
| Different word | nest, cake, ring, duck | coat |
| Same letters | h,a,n,d,c,o,a,t, g,i,r,l,s,h,o,e. | girl |
| Same word | hand, coat, girl, shoe | shoe |
| Control |  | |

Table 4

TYPES OF VISUAL DISCRIMINATION TASKS

Simultaneous (same page)

| | | | | |
|---|---|---|---|---|
| hand | hand | coat | girl | shoe |

Successive (different page)

| |
|---|
| hand |

| | | | |
|---|---|---|---|
| hand | coat | girl | shoe |

Table 5

TRAINING GROUPS

| Training: Printed word + | Kinds of Words | |
|---|---|---|
| | Dissimilar (gate, drum, nest, fork) | Similar (doll, ball, bowl, bell) |
| Picture | Group 1 | Group 2 |
| Auditory | Group 3 | Group 4 |
| Picture + Auditory | Group 5 | Group 6 |
| Auditory + Echoic Response | Group 7 | Group 8 |
| Picture + Auditory + Echoic Response | Group 9 | Group 10 |

Table 6

MEAN NUMBER OF CORRECT RESPONSES

| Training Method: Printed Word + | Dissimilar Word Groups (gate, drum, nest, fork) | | Similar Word Groups (doll, ball, bowl, bell) | |
|---|---|---|---|---|
| | Mean | Rank | Mean | Rank |
| Picture | 18.62 | 5 | 12.62 | 1 |
| Picture + Auditory | 20.94 | 4 | 11.86 | 2 |
| Picture + Auditory + Echoic Response | 21.14 | 3 | 11.43 | 3 |
| Auditory + Echoic Response | 22.10 | 2 | 11.19 | 4 |
| Auditory | 23.38 | 1 | 7.67 | 5 |

Table 7

DISTRIBUTION OF HIGH AND LOW READERS ON THE HARRISON-STROUD LETTER-NAMING TEST

| | Giving Names of Letters | |
|---|---|---|
| | Lowest 50% | Highest 50% |
| High readers | 0 | 24 |
| Low readers | 13 | 12 |