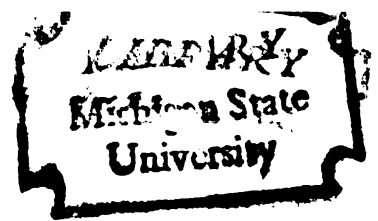THE EFFECTS OF REPETITION OF VERBAL AND
PICTORIAL IMAGES UPON THE ACHIEVEMENT
OF SECOND GRADE STUDENTS IN LEARNING
TO SPELL OBJECT WORDS

Thesis for the Degree of Ph. D.
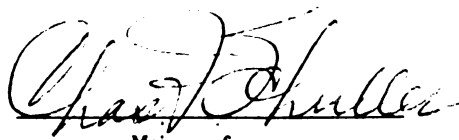MICHIGAN STATE UNIVERSITY
KEITH MILES COLLINS
1971

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Major professor

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ABSTRACT

THE EFFECTS OF REPETITION OF VERBAL AND
PICTORIAL IMAGES UPON THE ACHIEVEMENT
OF SECOND GRADE STUDENTS IN LEARNING
TO SPELL OBJECT WORDS

By

Keith Miles Collins

Purpose of the Study

This study was conducted in an attempt to determine what effect the repetition of verbal and pictorial images would have upon the achievement of second grade students in learning to spell selected object words.

The study explored two questions: (1) Will a visual which has repetition of verbal and pictorial images within its framework have a positive learning effect on the achievement of students in learning to spell object words? (2) Will a visual which has repetition of verbal and pictorial images within its framework have a positive effect on the retention of that learning? In an attempt to answer these two questions the following null hypotheses were investigated:

1. There will be no significant difference due to treatment effects;

2. There will be no significant difference between post-test and retention test scores;

3. There will be no significant treatment by repeated measures interaction.

Design and Procedures

Thirty-six classes of second grade students from a middle class school district were randomly selected to participate in this study. The 36 classes involved a total of 1016 students. Each of the 36 classes was then randomly assigned to one of the four treatment groups, thus making a total of nine classes involved in each treatment.

A list of 20 words from Follett's Spelling and Writing Patterns, Book C, written by Morten Botel was compiled. Because of the nature of the experiment--that of repeated verbal and pictorial images with paired associates--only object words were chosen for presentation. Each object word and a picture of the corresponding object was photographed and used on slides in four different configurations resulting in a set of 20 slides for each of the four treatments.

The different treatments on the slides were as follows: The slides for Treatment I contained six repetitions of a single spelling word plus one picture of the corresponding object. Treatment II presented one spelling word and six identical pictures of the corresponding object. Treatment III presented one picture of the object and the corresponding spelling word. Treatment IV presented slides containing only the picture of the object with the teacher pronouncing the word as the picture was shown.

All treatments consisted of the following steps for each of the 20 words:

1. Presentation of stimulus.

2. Oral pronounciation of the word by the teacher
    and then by the class in unison.

3. Class attempt to write the word.

4. Correct spelling presented followed by student
    self-correction.

In the post-test and retention test, no self-corrective technique was used. The treatment was administered over four days using the following identical fading technique in all four treatments for the 20 words.

Day 1. Student shown slides with complete
        spelling of word.

Day 2. Student shown slides with first and
        last letters of the word.

Day 3. Student shown slides with first letter
        of the word.

Day 4. Student given post-test consisting of one
        picture slide of each object.

One week later. Retention test--a replication of
        the post-test given.

A two-way repeated measures analysis of covariance was used to test the three main hypotheses to determine which of the four treatments was the most effective method of instruction for teaching the spelling of object words. The unit of analysis utilized was the classroom mean. The covariate for this particular study was the spelling ability of the students as determined by a standardized spelling test administered prior to treatment. The independent variable consisted of the four treatments: 1. The six words

and one picture treatment; 2. The six pictures and one word treatment; 3. The paired associated or one picture and one word treatment; and 4. The picture-verbal treatment. The two dependent variables were the mean score on the post-test immediately following the treatment and the mean score of the retention test given after a duration of one week.

Conclusions

Analysis of the data supports the following conclusions:

1. In comparing the relative effectiveness of six words--one picture, six pictures--one word, one word--one picture, and one picture with oral pronounciation in a slide presentation utilized to teach the spelling of object words to second grade students, no significant difference was found in the number of spelling words correctly learned by the students or retained after seven days.

2. A significant difference was found when the scores of the post-test and retention test were compared. This analysis indicates that a significant number of the words learned as a result of the treatment was forgotten after a period of one week.

3. Analyzing the effects of treatment by repeated measures interaction, there was no significant difference found. This indicated that there were no differential treatment effects across time.

THE EFFECTS OF REPETITION OF VERBAL AND

PICTORIAL IMAGES UPON THE ACHIEVEMENT

OF SECOND GRADE STUDENTS IN LEARNING

TO SPELL OBJECT WORDS

By

Keith Miles Collins

A THESIS

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To the staff of the Instructional Resources Center who continuously gave advice and support.

This work is dedicated to my wife, Mary Lou, whose love, tenderness, and empathy were the final ingredients for the successful completion of this venture.

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It is proposed in the present study to take Petty's statement and examine it further.

Purpose of the Study

The purpose of this study was to determine the validity of the repetition of verbal and pictorial images as a factor in the rote learning process. A spelling exercise was used to test the effect of the repetition of verbal and pictorial images on children's learning to spell new words.

Hypotheses

The following hypotheses were generated to examine the effectiveness of the repetition of verbal and pictorial images:

1. There will be no significant difference due to treatment effects.

2. There will be no significant difference between post-test and retention test scores.

3. There will be no significant treatment by repeated measures interaction.

Definitions of Terms

Visual and verbal repetition--The recurrence of identical visual and verbal images within the framework of the single stimulus.

Perception--A person's awareness of objects in the environment.

Object Words--Words which are associated with animate and inanimate objects.

Paired Associate Approach--The matching of the word and the picture of the object within the framework of a single stimulus.

Contribution to Education

Should the repetition of verbal and pictorial images be found to be a positive factor in the teaching of spelling, it could contribute positively to existing spelling methodologies.

An investigation of the literature has failed to reveal a previous study of the repetition of verbal and pictorial images as a factor in the teaching of spelling. Were the repetition of images to prove an effective approach, it would be possible to develop effective self-instructional materials of significant value in learning to spell. For example, a series of slides could be presented representing the words that the student is expected to master. Following a pretest, the students would be given only those slides containing the words missed, and he could then work on those words, individually, in a learning carrel.

If the repetition of verbal and pictorial images is found to be an effective element in learning to spell, it is possible that it could be of value in other comparable subjects such as the instruction of Morse Code.

Limitations of the Study

There are several limitations of the study which should be mentioned, two of which are imposed by the investigator to delimit the study and two arising from general principles.

The investigator chose only object spelling words to be presented in the study because of complexities involved

in picturing non-object words such as "over" and "through."
The teaching of non-object words is doubtless of equal
interest to the teachers of spelling. Further, the pre-
sentation rate was fixed for all treatment groups. It may
be of interest for investigators who follow to allow the
student to determine his own presentation rate.

Staying within the constraints of customary proce-
dures, the results of this experiment cannot be generalized
beyond the experimental population. However, the Tukey-
Cornfield position can be applied.[9] They argue that the
findings can be applied to populations who have like demo-
graphic backgrounds. They leave this choice up to the
person who wishes to apply the findings to other populations.

Theory and Rationale

In light of the research findings previously men-
tioned, this study dealt with one aspect of perception in
learning spelling. More specifically, it dealt with the
use of the repetition of verbal and pictorial images and
their effect upon the way second grade children learn spell-
ing skills. Specially designed visuals were utilized. They
have been created out of the context of the spelling research.
For example, words were not placed in a sentence on the
screen but stood alone. This configuration was chosen on the

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[9]Jerome Cornfield and John Tukey, "Average Values of
Mean Squares in Factorials," Analysis of Mathematical Statis-
tics, Vol. 27 (1956), pp. 907-49.

basis of a study reported by Stephen Sherwin. Sherwin's study found a difference between what might at first seem a logical presentation, that of including the word in a sentence for clarification of meaning, and what might seem an undefined presentation, that of the actual findings which emphasize the column method of presentation.

> On theoretical grounds, it has been maintained that teaching spelling in a prose context is desirable because learning will transfer more readily to the context in which the student wishes to use the word. The experimental evidence, however, indicated that the column method is more effective and efficient.[10]

On the basis of this research, the column method was used. However, the linguist should not be dubious because contextual material lies in the pictorial design. This would seem to make a bridge between the opposing forces. The figural, oral, and columnar presentation relates to both philosophies in satisfying the claims for multisensory perception and traditional columnar configuration.

Another technique used was that of fading. This technique requires that letters be removed on each successive exposure of the visual. Thus, the first visual presented the word in its entirety. The second visual consisted of removing the middle letters of the word, thus leaving only the first and last letters. The third visual consisted of the first letter only. The fourth and last visual contained no letter prompts, thus necessitating total recall.

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[10]Sherwin, <u>Four Problems in Teaching English</u>, p. 107.

In terms of the testing mode, it would seem logical that letter combinations which are the most difficult to remember should be faded out last in order to increase the exposure of these difficult sections. However, research indicates that this apparently logical procedure is ineffective. As Sherwin concluded on the findings of Tireman, "After assessing the findings and how they were reached, teaching hard spots is a waste of time."[11] Further justification of the fading technique was developed in relation to perceptual design.

Research in spelling to this point has been primarily in the Language Arts area. The present research concentrates instead in the area of perceptual design. In that effort we must face the fact that the research base in the field of perception applicable to the present study is limited. As Miller indicates:

> We have already seen that the application of graphic techniques to education is a part of the general problem of the curriculum. Similarly, the problem of discovering fundamental principles of graphic communication is a part of the general problem of the psychology of perception, motivation, and learning. Discovering more about fundamental principles will help us to improve all media and should tell us under what conditions one medium will be superior to another.[12]

[11] Ibid., p. 106.

[12] Neal Miller, et al., Graphic Communication and the Crisis in Education (Washington: Department of Audio Visual Instruction, 1957), p. 61.

The present study undertakes to supply further experimental evidence which may contribute to knowledge about such fundamental principles.

> Projected materials that require a projector have some qualities in common that are inherent in the fact that they are projected. First of all, projected materials require a strong source of light in a relatively darkened room, and consequently they attract and hold attention. Psychologists tell us that it is an almost uncontrollable human characteristic to look at a spot of light in a darkened room.[13]

It has also been discovered that visual learning of a cognitive skill has a greater potential in message receptivity than does auditory learning. Werner Severin indicates, "For verbal materials in single channel situations, the visual channel (printed message) appears to have greater capacity than the auditory channel (spoken message)."[14] The auditory and visual channels were combined in hopes that the combination of the two channels would result in the most effective information presentation. "Multichannel communications which combine words with related or relevant illustrations will provide the greatest gain because of the summation of cues between channels."[15] Thus in accompaniment with the visual design

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[13]Robert C. Snider, "Selection and Use of Visual Media," in Research Principles, and Practices in Visual Communication, ed. by John Ball and Francis C. Byrnes (Washington: Department of Audio Visual Instruction, 1961), p. 124.

[14]Werner Severin, "Another Look at Cue Summation," AV Communication Review, 15 (Fall, 1967), p. 243.

[15]Ibid., p. 243.

which consists of the printed word and its illustration, the word was also pronounced.

From the field of learning theory came the concepts of active participation in learning by students and immediate reinforcement of answers through the presentation materials. Active participation in learning was encouraged by having the children write each word as it was presented.[16] Immediate reinforcement was accomplished by showing the students the correct spelling on the screen after each word was written.[17]

The teaching of spelling of object words through repetitive verbal and pictorial images incorporates theories from three fields. The teaching of spelling in the columnar fashion and the omission of teaching the difficult letter combinations come from Language Arts research. The use of projected materials, the paired associate technique, and the utilization of seven bits of information per visual were based upon research in perceptual psychology all of which will be discussed in Chapter III on the design of the study. On the basis of S-R Theory, the techniques of student participation and immediate reinforcement were employed in the instruction. Thus, Language Arts, perceptual psychology, and learning theory have been combined to develop the experimental method used in this study.

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[16]John DeCecco, The Psychology of Learning and Instruction: Educational Psychology (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1968), p. 286.

[17]Ibid., p. 256.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

In this chapter, studies relevant to the present investigation are reviewed. This chapter is divided into three sections: (1) learner pictorial preference studies, (2) eye-movement studies, and (3) visual redundancy studies. Each of these three areas has a distinct set of literature and research. Part of the task of this chapter is to coordinate these three areas to form the rationale for this study.

Psychologists have contributed a large body of research on perception. The majority of these perception studies are theoretical, probing the various aspects of human perceptual abilities. While these studies have no immediate practical applications, they provide clues upon which learning methodologies and procedures can be constructed and tested.

During World War II, while experimenting with perceptual acuity, the Armed Services found the most expeditious ways to teach personnel split-second plane

and ship identifications, recognition of logos, shapes and
sizes of different craft; and they designed pictures to
teach these skills. These studies were done by Gibson[1]
and Renshaw.[2] While these findings served well for the
adults, it was found in later studies that young children
must be provided with a different set of learning devices.
The picture preference of children differed radically from
the adults'. The children preferred simplistic pictures
while the adults preferred more detailed pictures. For
this reason, the studies included in this discussion deal
with primary children because it is the population with
which this study is concerned.

The studies on eye movement are primarily physiol-
ogical in nature. These studies were done by Buswell,[3]
Brandt,[4] Wolf and Tira,[5] and Mason.[6] The studies were

[1] J. J. Gibson, ed., Motion Picture Testing and
Research, Army Air Forces Aviation Psychology Program
Research Reports, No. 7 (Washington, D. C.: Superintendent
of Documents, Government Printing Office, 1947).

[2] Samuel Renshaw, "The Visual Perception and Repro-
duction of Forms by Tachistoscope Methods," The Journal of
Psychology, Vol. 20 (1945), pp. 46-52.

[3] Guy Buswell, How People Look at Pictures (Chicago:
University of Chicago Press, 1935).

[4] Herman F. Brandt, The Psychology of Seeing (New
York: The Psychological Library, 1945).

[5] Willavane Wolf and Daniel Tira, "How Visual Clues
Influence Children's Eye Movement," in Proceedings of the
First National Conference on Visual Literacy, ed. by Clar-
ence Williams and John Debes (1970).

[6] George E. Mason, "Prolonged Visual Discrimination
in Beginning Reading," in Proceedings of the First National
Conference on Visual Literacy, ed. by Clarence Williams and
John Debes (1970).

conducted to better understand the natural movements of the eyes in comprehending a sign, a poster, or other types of designs. The eye-movement studies have relevancy for this investigation because they give insight as to how people look at visual images, thus allowing the designers of the visual to make more efficient designs.

The studies dealing with redundancy, for the most part, deal with the simplication or elaboration of a single visual image. For example, they present a simplified line drawing of an object and a detailed picture of the same object. The detailed picture is considered a "redundant" picture. Other redundancy studies are concerned with mirror images. Random and systematic designs were used in these studies. They were repeated by using mirror images of the original design. The task of the subjects then was to copy the original single design on paper. The repetition of verbal and pictorial images which is defined in this study as "the recurrence of the identical visual within the framework of the single stimulus" does not parallel or equal the meanings inferred by the above discussion. While the redundancy studies do not relate directly to the repetitive image technique employed in this study, secondary findings from these studies have relevance to the present investigation as noted in the discussion on pages 27 to 31.

This investigation, further, is reporting an experiment designed ultimately to serve in the development of a

possibly more efficient and effective instructional design--
the repetition of verbal and pictorial images. The areas of
research basic to the study of the repetition of verbal and
pictorial images include: (1) learner pictorial preference
studies which relate to how successful the student correctly
learns the concept presented, (2) eye-movement studies which
are designed to determine what types of visual arrangements
are best perceived by the learner, and (3) visual redundancy
studies which seek to establish the variable of interest as
an element in message design.

Learner Pictorial Preference Studies

Learner pictorial preference studies were deemed
appropriate for inclusion in this chapter because the way the
learner interprets the picture is directly related to whether
or not he correctly learns the concept being presented. This
is particularly important because the pictures are being used
as graphic devices to teach the concept in place of the real
object. As Julian Hochberg points out,

> When it is desirable in instruction to replace the
> real world with some substitute or surrogate such
> as a photo or drawing, it is important to know
> something about how to represent the reality ade-
> quately for perceptual purposes.[7]

Investigation of the literature revealed that there
has been some concern about what types of pictures are the
most effective learning devices for children. According
to Travers, for example:

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[7]Julian Hochberg, <u>Perception</u> (Englewood Cliffs, New
Jersey: Prentice Hall, Inc., 1966), p. 1.

. . . Significant problems have become evident as research on the use of illustrations in the education of young children has developed and as findings have emerged suggesting that these children respond quite differently from the adult to illustrations in textbooks and generally obtain much less information from them.[8]

Such findings seem to suggest that the research on adults is not germane to the present study because the adults differ from the children in their preferences among visual stimuli and therefore designs must be significantly different in complexity. This study limits the visual stimuli to simple images that appeal to children.

The studies by Travers and others of the preferences of young children investigated the following relationships: (1) whether the picture should be colored or black and white; (2) whether the picture should be a concrete or abstract representation of the object; and (3) whether there are types of pictures that are the best for a particular learning situation.

Mabel Rudisill from Drake University, in 1952, investigated the significance children attach to realism and color. She was interested in any differentiations found within the variables of realism and color as indicated by children of the different age groups. Rudisill reported the following conclusions with respect to the pictorial preference of children in kindergarten through grade four:

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[8]Robert M. W. Travers and Victor Alvarado, "The Design of Pictures for Teaching Children in Elementary Schools," Audio-Visual Communications Review, Vol. 18, No. 2 (Spring, 1970), p. 47.

1. If two pictures are identical in all other
respects, most children prefer a realistic colored
one to an uncolored one. 2. If different pictures
include the same subject matter and the same color,
most children prefer the one which is treated in such
a manner as to give the truest appearance of realism
or lifelikeness. 3. If different pictures include
the same subject matter, most children prefer an
uncolored one which gives them an impression of
reality above a colored one which does not seem to
conform to reality. 4. If different colored pictures
include the same subject matter, most children prefer
a less colored one which gives a greater appearance
of reality above more colorful ones which appear less
lifelike.[9]

A related study by French analyzed the preference
of children of different ages for pictures of varying com-
plexity. The population consisted of a group of six year
old children. French tested reactions to thirteen paired
pictures; each set consisted of a complex picture and a
simple picture of the same subject. French reported:

. . . the one hundred and forty-two first grade
children, all six years of age, showed an eighty-
three percent preference for simple illustrations.
Although the degree of preference on the individual
items ranged from ninety-two to seventy-four per-
cent, there was a valid preference for the simple
version in each pair.[10]

This is further evidence of the young child's preference
for simple pictures rather than complex pictures.

Taylor investigated the relationship of types of
pictures to the type of concept to be learned. His con-
clusions suggest that the type of picture which the

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[9]Mabel Rudisill, "Children's Preference for Color
vs. Other Qualities in Illustrations," Elementary School
Journal, LII (1952), p. 451.

[10]John E. French, "Children's Preference for Pic-
tures of Varied Complexity of Pictorial Patterns," Ele-
mentary School Journal, LIII (1952), p. 93.

communicator should use depends upon the learning domain he

is trying to influence:

> In concrete messages, the visual symbols should be
> as pictorial or photographic as possible. In abstract
> communications the problem is far greater. Fre-
> quently the use of complex structural symbols are
> required: abstract shapes in moody paintings, complex
> formulas in mathematics, etc. There is much indica-
> tion that of three major forms of visual symbols, the
> icon such as photographic or realistic representation
> is best for messages where seeing is essential;
> schematic presentation, where exact relations requir-
> ing thought and problem solving are depicted, as in a
> blueprint; and abstraction, with irregular undefined
> shapes, particularly with colors, so as to produce
> motivation, movement, and attention. Thus, one should
> clarify whether the translation of ideas should be
> essentially in perceptual (seeing), cognitive (think-
> ing), or affective (feeling) terms.[11]

In a slightly different type of study dealing with

cue and response functions of pictures and words, Lumsdaine

stated that,

> Presenting pictures is more effective than present-
> ing words as a stimulus in rote association tasks
> such as learning a foreign language.[12]

From these studies it appears that pictures used

for early elementary students should be uncomplicated and

realistically colored if maximum utility is to be realized.

Eye-Movement Studies

Eye-movement studies play an important part in

determining whether or not a visual is an effective learning

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[11]I. A. Taylor, "Principles in Design," in Research, Principles, and Practices in Visual Communication, ed. by John Ball and Francis Byrnes (Washington: Department of Audio Visual Instruction, 1961), p. 109.

[12]A. A. Lumsdaine and M. A. May, Learning from Films (New Haven, Conn.: Yale University Press, 1958), p. 141.

device. Through the use of eye-movement studies, the
types of visual designs which are best perceived by the
learner can be determined. Fleming, in his summary of
perceptual research, states:

> . . . A general consideration of eye movements is
> important to the designer's understanding of atten-
> tion. For example, how do we achieve stable per-
> ceptions when our eyes are so frequently "swish
> panning" from point to point in the scene like
> motion picture or television cameras, doing so an
> 'impossible' three or so times a second.[13]

The designer of visual stimuli should also be con-
cerned about the way the students respond to the type of
design which he has created. As Wolf and Tire point out:

> It may be of interest to you (the designer of the
> stimulus) to know specifically how students are
> responding to these visual stimuli.[14]

Eye movement presents an unusual opportunity for
finding out these reactions since they give information
on where the subject is looking, how long he looks at a
particular spot, how often he looks at a particular object,
and the magnitude of his eye movements from object to
object or place to place.

The eye-movement studies which seem appropriate
to this study concern how the human eye scans a visual
image for contextual clues. Most of these studies deal
with the physiological aspects of the human eye. These
studies are not directly concerned with whether or not
the content of the visual is learned; rather, the focus

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[13]Fleming, op. cit., p. 16.

[14]Wolf and Tira, op. cit., p. 101.

is upon the muscle movement of the eyeball when a visual

is presented to the subject. The earliest study found in

the literature dealing with eye movement was an investiga-

tion done by Guy Buswell at the University of Chicago.

Buswell's comprehensive study arrived at several conclu-

sions. The conclusions which are relevant to this topic

of discussion were as follows:

> Two general patterns of perception are apparent in
> the records. One of these consists of a general
> survey in which the eye moves with a series of rela-
> tively short pauses over the main portions of the
> picture. A second type of pattern was observed in
> which a series of fixations, usually longer in dura-
> tion, are concentrated over small areas of the pic-
> ture, evidencing detailed examination of those
> sections. . . . Wide differences were found both in
> the general pattern of perception in looking at a
> picture and in duration of fixations. . . . The per-
> ceptual pattern for various types of repetitive
> designs showed clearly that the pattern of eye move-
> ments does not resemble even remotely the general
> pattern of design . . . The comparison of a set of
> records made by a small group of children with those
> made by adult subjects showed no consistent differ-
> ences.[15]

Herman Brandt, the Director of Visual Research

Laboratories at Drake University, in 1945, did a follow-up

study and came to somewhat different conclusions:

> The results of the study revealed that the median
> of the first fixation for all subjects falls at a
> point above and to the left of center of the
> observed field.[16]

The Brandt study found that the initial fixation falls to

a point above and left of center to the observed field in

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[15]Buswell, op. cit., p. 142-4.

[16]Brandt, op. cit., p. 30.

contrast to Buswell's finding of a general survey of the

visual image. Brandt continues with his findings:

> Two general types of eye movements are commonly
> employed by the average individual. One is the
> exploratory type in which the individual makes a
> general survey of the entire field under observa-
> tion and the other is a more detailed examination
> in which that subject returns to the areas observed
> earlier for a clear inspection.[17]

In another study by Wolf and Tira, the subjects

were grouped by IQ scores and then exposed to a visual

which contained both pictorial and verbal material within

the context. Wolf and Tira explained the results of their

study as follows:

> I.Q. comparisons were made on scenes with similar
> visual content which were introduced at different
> points in the stimulus field. This was done to
> determine the consistency of the eyemarkers for the
> I.Q. groups in identical stimulus areas. The scene
> used to test this hypothesis was from an A-Jax
> commercial which had three identifiable areas: 1.
> box; 2. commercial message beside the box; and 3.
> other (which represents eyemarkers falling in areas
> not defined by the two major areas of stimuli). In
> the initial scene, the high I.Q. group concentrated
> a great portion of the time on the words (sixty
> percent) and relatively little on the box (nineteen
> percent). On the second scene, the elements in the
> visual scene were with nineteen percent of the eye-
> markers falling on the words and fifty-six percent
> of their eye-markers falling on the box. On the
> other hand, the low I.Q. group's visual pattern was
> fairly constant with regard to the two scenes.
> Forty-two percent of their eye-markers fell on the
> words in the first scene with forty-five percent of
> them falling in this same area on the second.[18]

This study indicates that subjects with high I.Q.'s place

a priority on the verbal messages while subjects with a

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[17]_Ibid._, p. 39.

[18]Wolf and Tira, _op. cit._, p. 107.

lower I.Q. seem to be about evenly divided between the verbal and visual parts of the message.

Another experiment by Mason dealt only with printed words being presented to the subjects. This study also found some individual differences. Mason concluded:

> Three general patterns of observations were noted. Some looked at each letter in a left-to-right order. Some looked at the middle letter first, then to the left and finally to the right.[19]

It appears that the findings of these studies are somewhat in conflict with each other in that some of them indicate that the subject makes a general survey of the field and returns to make a detailed observation, while the other studies report that there are no general patterns which subjects seem to follow. However, it was not reported in the studies done by Buswell, Brandt, and Mason that the subjects' I.Q. scores were taken into consideration. This may be the cause of the important difference in the findings reported. In most classrooms there is heterogeneity as far as the students' I.Q. scores are concerned. Therefore, based on the findings of the studies reported, one can hypothesize that it is important to design the visual message in a manner that will accommodate variations in I.Q.'s and in the physiological processes used to abstract the meaning of the visual.

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[19]Mason, op. cit., p. 98.

Visual Redundancy Studies

A search of the literature on visual redundancy

was made because of its essentiality to the study as a

variable of interest and as an element of message design.

Charles Hoban supports this rationale:

> Redundancy is one of the fundamental means of
> communicating information for which the sense
> organs of the body, particularly the eye, seem
> to be constructed. Furthermore, redundancy
> seems to be a requirement for human's certainty
> of information. In research supported theory,
> it is a most generally effective determinant of
> learning.[20]

The use of redundancy in the visual stimuli designed for

this study is based on the research reported by Hoban.

Besides this type of repetition, other studies are cited

in this section which deal with redundance as an increase

in detail or the use of mirror images.

Henneman and Long surveyed the perceptual litera-

ture dealing with visual and auditory senses and concluded

among other findings that:

> The visual senses probably afford more redundancy
> than audition because of the greater overall sensi-
> tivity to spatiality and temporarily distributed
> stimuli combined.[21]

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[20]C. F. Hoban, The Usable Residue of Educational
Film Research, New Teaching Aids for the American Class-
room (Stanford: Stanford University, The Institute for
Communication Research, 1960), p. 52.

[21]R. H. Henneman and E. R. Long, "A Comparison of
Visual and Auditory Senses as Channels for Data Presenta-
tion," in Research and Theory Related to Audiovisual Infor-
mation Transmission, ed. by Robert N. W. Travers (Kalamazoo,
Michigan: Western Campus Bookstore, 1967), p. 91.

It was earlier pointed out that redundancy is an effective determinant of learning. However, care must be taken in employing this device or the advantages of redundancy can be reversed. Maurice Rappaport examined the role of redundancy and its use in the discrimination of visual forms and reported that:

> In certain situations there may exist a balance of effects between the beneficial characteristics of various types of redundance and the detrimental features that arise when redundancy is introduced in great amounts or in an ineffective way.[22]

This suggests clearly that the type and amount of visual redundancy built into the visual is an important factor in its effectiveness in communications.

Travers supports Rappaport's view:

> Experiments at the University of Utah have commonly reported that, in conducting studies of the audio-visual transmission of information, subjects exposed to a high ratio of information both involving vision and hearing commonly place their hand either over their eyes or over their ears. Such action may prevent the nervous system from becoming overloaded and provide evidence that the nervous system is limited in its capacity for handling information.[23]

These findings are important to the visual designer because it can be concluded that redundancy must be carefully used. Too much redundancy incorporated in the message of the visual, may actually work in opposition to the intent of the communication device.

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[22]Maurice Rappaport, "The Role of Visual Redundancy in the Discrimination of Visual Form," _Journal of Experimental Psychology_, Vol. 53 (1957), p. 9.

[23]Travers, _op. cit._, p. 165.

Miller gives some insight into the question of how much information can be incorporated into a visual. While Miller's study does not deal with pictorial materials as such, it is relevant to the question of the degree of redundancy which can be accommodated by a viewer. He used numbers of dots exposed for short time spans and measured relative degrees of accuracy achieved by his subjects in judging the number of dots present.

> Anywhere from one to more than 200 dots could appear in the pattern. The subject's task was to report how many dots there were. The first point to note is that on patterns containing up to five or six dots the subjects simply did not make errors. The performance on these small number of dots was so different from the performance with more dots that it was given a special name. Below seven, the subjects were said to subtiltize, above seven, they were said to estimate. This is, as you will recognize, what we once optimistically called "the span of attention."[24]

Miller's study suggests that the use of seven or fewer stimuli images will preclude making the number of images a problem variable. The present study was conducted using a tachistoscope and the exposure of the stimulus was only a fraction of a second. However, there were no projections in the study made for the visual channel capacity if a longer time was used.

A study by Hintzman gave further information on the question of time needed by a subject to read and learn a series of words.

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[24]George A. Miller, "The Magical Number Seven Plus or Minus Two," in Readings in the Psychology of Cognition, ed. by Richard C. Anderson and David P. Ausobel (New York: Holt Rinehart and Winston, Inc., 1966), p. 255.

The lack of substantial effect of exposure duration
suggests two explanations: memory processing is
instantaneous; i.e., it ordinarily takes the sub-
jects only a short time (less than two seconds)
to process a word into memory; and, after this has
been done, he stops processing the stimulus until
a different word is presented.[25]

When redundancy and time factors are considered

together, however, the problem becomes somewhat compounded.

Garner, provides some information as to these two variables

in conjunction:

> . . . we should note that redundancy while producing
> more discriminability, does so by increasing the
> amount of difference between stimuli. Therefore, we
> might well expect that while maximum accuracy should
> improve, a longer discrimination time will be required
> for the subject to make use of the additional dis-
> criminating cues. In other words, discrimination will
> improve with increased redundancy, but at a cost of
> time.[26]

Erickson and Hake support the value of redundancy in

developing discrimination:

> The present study was concerned with the contribu-
> tion of multidimensional stimulus differences to
> accuracy of discrimination. Discrimination accuracy
> was determined by the method of absolute judgment
> for a series of stimuli varying along the dimension
> of size, hue, and brightness. The results of the
> present study show quite clearly that compounding
> dimensional differences among stimuli results in a
> large and significant improvement in discrimination
> using the absolute method of judgement.[27]

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[25]Douglas L. Hintzman, "Effects on Repetition on
Exposure Duration on Memory," _Journal of Experimental
Psychology_, LXXXIII, 3 (1970), p. 443.

[26]Wendell R. Garner, _Uncertainty and Structure as
Psychological Concepts_ (New York: Wiley, 1962), p. 195.

[27]C. W. Erickson and H. W. Hake, "Multidimensional
Stimulus Differences and Accuracy of Discrimination,"
Journal of Experimental Psychology, 1 (1965), p. 153.

Another factor having effect on learning or memory appears to be the patterning of the visual. One finding by Attneave who studied the effects of patterning on memory of visual images was that:

> The symmetrical patterns were remembered more easily than asymmetrical patterns occupying the same number of cells.[28]

Examples of the type of drawings used were:
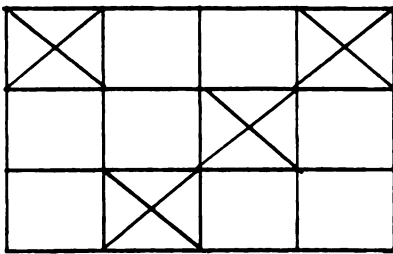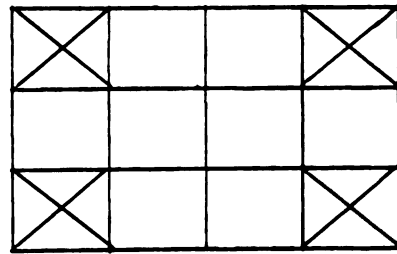
Asymmetrical   Symmetrical

The redundancy studies reported in this section reveal that when redundancy is used in the stimulus, care must be taken for the kind and amount of redundancy employed. They also indicate that if maximum learning is to take place, the time which the subject is exposed to the stimulus must be taken into consideration. Thus type, time, amount, and patterning are all important factors which must be taken into consideration in order to produce an effective and efficient visual and these factors need skillful manipulation.

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[28]Fred Attneave, "Symmetry, Information, and Memory for Pattern," _American Journal of Psychology_, L 2 (1955), p. 221.

Three variables--eye movement, pictorial preference, and visual redundancy--must be taken into account if an effective visual presentation is to be constructed. Studies cited in this chapter indicate that the effective stimulus methodology to be employed must use these variables. Therefore the visuals to be used in this study will be based on this research. The mere fact that the subject is exposed to the material is no guarantee that the material will be learned. The designer must realize that all people do not look at a visual in the same manner. He must also be aware that children of different ages prefer different types of pictorial materials. The encoder must also be aware of the effect of redundancy; if there is too much or too little, the effect of the stimulus will be reduced. It appears necessary for the selector or designer of visual messages to take such factors into account if the results are to be of significant benefit to the decoder, the learner. The effectiveness and efficiency of any visual message can be positively influenced by careful accommodation of the variables of eye movement, age level preference, and visual redundancy.

CHAPTER III

DESIGN OF THE STUDY

Introduction

This study investigates the effectiveness of the repetition of verbal and pictorial images in the teaching of spelling of object words. Discussion of the study design is divided into four parts: (1) visual design theory; (2) the basis for word selection; (3) the pilot study; and (4) a description of the actual experience.

Visual Design Theory

Visual designs created for this experiment in Language Arts were constructed upon concepts garnered from perceptual psychology and learning theory.

On the basis of perceptual design, the paired associate configuration for presenting the stimulus was selected. This design is the combination of the object word spelled out and the pictures of the object presented simultaneously in different configurations. (See Appendix C.) Travers reports evidence corroborating the effectiveness of labels and pictures in simultaneous presentation: "There is also evidence that simultaneous presentation of name and pictured

object or situation will facilitate memorizing or associating the two."[1]

Another factor built into the visual was that of redundancy. Ordinary speech is highly redundant. This is indicated in the ability of humans to understand compressed speech. For this reason, the visuals are felt to be strengthened if visual redundancy is built into their design. As communication theorists point out, "When encoding a message, it seems necessary to incorporate in it a certain amount of redundancy."[2]

An important question relating to the design of the visual treatments in the study was how much redundancy should be built into a visual before the channel becomes overloaded and distracts from the intent of the visual? In a summary of studies in this area, Miller indicates that,

> The amount of information that an individual human
> is able to handle is limited, and the maximum is
> apparently seven 'bits.'. . . If the units of infor-
> mation are changed, so the individual is able to
> group events in a meaningful fashion, the amount of
> information that can be handled by the individual
> is somewhat larger.[3]

In consequence, the present study employed a maximum of seven cues in the visuals.

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[1]Robert M. Travers, Research and Theory Related to Audiovisual Information Transmission (Kalamazoo, Michigan: Western's Campus Bookstore, 1967), p. 107.

[2]Stacy Adams, "Communication Effects," Visual Communication, ed. by Ball and Byrnes, p. 41.

[3]George A. Miller, "The Magical Number Seven Plus or Minus Two," Readings in the Psychology of Cognition, ed. by Richard C. Anderson and David P. Ausobel (New York: Holt Rinehart and Winston, Inc., 1966), p. 254.

It was postulated that if the children remained passive as the visuals and the spoken words were presented, maximum learning efficiency would not be reached. Ball and Byrnes point out the importance of this activity.

> Student participation exercises are well worth consulting by those who wish to improve the effectiveness of visual aids in classroom instruction. The available evidence suggests that such methods can contribute appreciably to student motivation in a classroom situation, relieving boredom and inattention, but that their primary contribution is the direct effects on practice that is provided on the learning of specific material.[4]

Based on this analysis, the students were required to write the exercise words and pronounce them as each was presented.

The fading technique which was discussed in relationship to teaching the different letter combinations of words was also utilized. The justification for the processes used in the fading technique was based on Lumsdaine's conclusion from word recall studies that,

> The beginning fragments produced significantly higher recall than the other fragments, and the middle fragments elicited the poorest recall. . . . Studies of functional stimulus in verbal learning have demonstrated that the first letter of a verbal item is frequently a dominant factor in the student's strategy for learning the item.[5]

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[4]A. A. Lumsdaine, "Decisions in Planning Communications," Visual Communication, ed. by Ball and Byrnes, p. 89.

[5]Henry Loess and Allan Brown, "Word Fragments as Aids to Recall the Whole Word," Journal of Experimental Psychology, 180, No. 2 (1969), p. 384.

Word Selection

One of the concerns in this study was the selection of appropriate words to be used. The words had to be object words due to the limitations involved in picturing non-object words. For example, the words _almost_ or _because_ would be extremely difficult to visualize. Abstract concepts (non-object words) have no single direct sign or symbol to represent them so that they become substantially more difficult to communicate pictorially. The words also had to be of sufficient difficulty so that the majority of the students would be unable to spell them correctly, but still within the students' vocabulary level. Establishment of the difficulty level was essential to establish the cause-effect relationship of the visual-verbal repetition technique employed in the study.

To assure that both of these conditions were met, the following selection procedure was employed. The first step was to make an appropriate spelling textbook series selection. The textbook series which was selected was Follett's _Spelling and Writing Patterns_[6] written by Morten Botel of the University of Chicago. Multi-sensory spelling experience undergirds the learning plan in Botel's _Spelling and Writing Patterns_. His recognition of multi-sensory learning and its implementation in his spelling book series made it especially appropriate to the needs

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[6]Morten Botel, _Spelling and Writing Patterns_, Book C (Chicago, Illinois: Follett Publishing Co., 1963).

of this study. Because this experiment was conducted in the spring of 1971, it was felt that most of the second graders had been exposed to the object words in their spelling book (Book B). Therefore, in order to assure the difficulty level of the words, within the constraints of the study, the words in the third grade spelling (Book C) served as the source from which to draw the word sample.

The next step was the selection of the object words from the total new word list presented in the third grade spelling book. This list contained 148 words. Because the book is part of a series, there were some words used in Book C which had also appeared in Book B. These words were deleted from the sample, leaving a selection of 134 object words. A list of 40 object words was then randomly selected from the total list by numbering the list, as it appeared, in alphabetical order and placing a corresponding set of numbered pieces of paper in a hat. The numbers were then thoroughly mixed and drawn without replacement until 40 numerical slips had been selected. These 40 numbered slips were matched up with the corresponding word which had the identical numerical assignment.

This list of 40 words was then given to three second grade classes consisting of 21, 19, and 20 students respectively. The words which 75 percent or more of the class failed to spell correctly were then included in the sample thus leaving a list of ten words which met the 75 percent failure criterion. A second list of 40 words was

then compiled by following the previously described method of selection. This second list of words was administered to the same three classes and the 75 percent failure criterion applied resulting in 12 additional words for the list or a total of 22 words.

The 22 word list was then further tested for difficulty-level by administering it to two second grade classes in a different school district (n = 21 and 24 respectively) and found to be valid. Two words were removed making a final list of 20 words. Several spelling books were perused, and it was found that regular spelling lessons usually present a twenty-word list of words. This spelling-lesson convention is followed in this study also. The two words dropped from the list were those that had the highest incidence of correct responses below the 25 percent criterion.

Preparation of the Materials

After the selection of the 20 words was established, the visuals were constructed. Several picture dictionaries were examined to determine which dictionary had the best simple realistic colored pictures of the words selected as established in the relevant literature. Another constraint which appeared was the amount of pictures any one dictionary had which corresponded to the selected words. In order to present consistent design in color, style, and size, the

picture stimuli were taken from one dictionary. The dictionary which was finally selected was <u>My First Dictionary</u>.[7]

Six of these dictionaries were purchased and the corresponding pictures were then cut from them, thus providing six identical pictures of the selected object words. Five of the words could not be found pictured in this dictionary. A professional artist was called upon to draw the five pictures not included in the selected dictionary taking into consideration the style, degree of complexity, and the size of the other pictures being used. The artist's renditions were line drawings which were then duplicated on a Xerox machine. The six copies of each picture were then colored to approximate as closely as possible the color quality of the printed pictures.

A master picture and word placement chart was then drawn up. The master was drawn up in a two by three ratio format. The format was drawn by taking into consideration the size of the pictures and the length of the longest word. The words for the visuals were produced by using Para Tipe Folio 24 point presstype which was the largest type most appropriate to the format. The letters were placed on a clear sheet of plastic in their respective configurations. The pictures were similarily placed on a white sheet of paper. The clear plastic sheets containing the appropriate words and configurations were then

[7]Laura Oftedel and Nina Jacob, <u>My First Dictionary</u> (New York: Grosset and Dunlap Publishing Company, 1970).

placed upon the white sheet. The configurations used were:
six words--one picture, six pictures--one word, one word--
one picture, and the pictures only. The following designs
indicate the word and picture placement for each of the
four treatments:

Treatment I

word	word	word
	picture	
word	word	word

Treatment II

picture	picture	picture
	word	
picture	picture	picture

Treatment III

word	picture

Treatment IV

picture
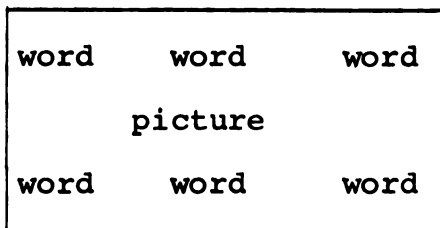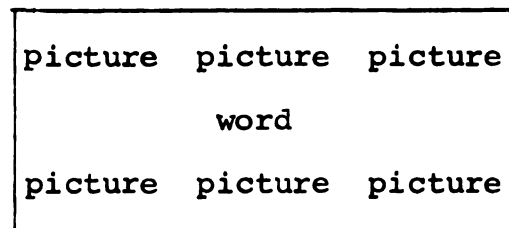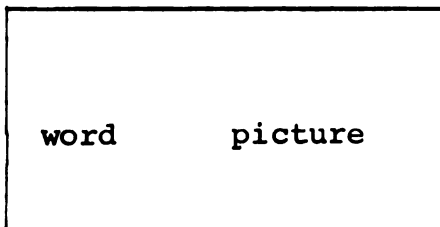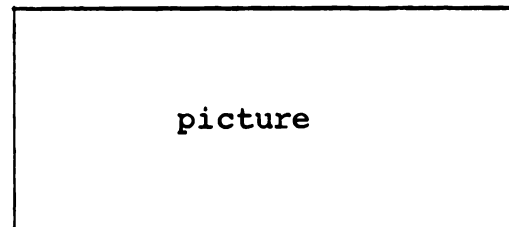
The slides were then photographed using a 35 mm
camera and copy stand. The type of film used was Koda-
chrome Professional Type A. The slides were then placed
in a Kodak carousel drum in alphabetical order with the
blank slides which were made from cardboard also put in
their respective order. The using of cardboard was
deemed the simplest to darken the screen rather than shut-
ting on and off the projector at the appropriate times.
Once these materials were compiled and properly sequenced,

the treatments could be formally scheduled. The slides
were set in carousel slide projector drums thus making
it possible to show the slides to the classes for presenta-
tion and testing.

Pilot Study

The maximum amount of stimulus in a single visual
was established in the literature as seven bits of informa-
tion. This criterion is used in designing the four con-
figurations to be used. The four treatments: six words--
one picture, six pictures--one word, one word--one picture,
and the picture only, were then taken back to the original
school for determination of the time needed for the stu-
dents to write one word before moving on to the next
word. It was found that a ten second exposure for each
visual and appropriate blank would give the students ade-
quate time to write the words.

The automatic timer on the projector was first
used in order to simplify the control of the exposure
time. However, this idea had to be abandoned because
occasional discipline problems arose which made it neces-
sary for the teacher to recycle the slide projector. Such
interruptions in the orderly rate of presentation made it
necessary to go to manual control by the teacher. The
participating teachers were instructed to keep the expo-
sure rate timed as closely to ten seconds as possible.

A pilot test with 83 second grade students estab-
lished the fact that the task was within the capabilities

of second grade students. The results of the pilot study
also indicated that the slides did, in fact, contribute
to the spelling skill of the students. Further, the stu-
dents had no difficulties in recognizing what the pictures
depicted. The retention test which was given one week
later seemed to indicate that some of the spelling words
had been forgotten.

The Experiment

Setting for the Study

The Warren Woods School District, an area of five
square miles, is located in the southeast section of the
city of Warren, a northern Detroit suburb. The school
district has witnessed a rapid growth pattern over the
past ten years. During that period, it has changed from
a rural two-school district serving 650 students to its
present suburban district status of 12 elementary schools,
two junior high schools, and a senior high school. During
the 1970-71 school year, 5,846 were enrolled in kinder-
garten through sixth, with a combined student population
of 9,216 attending kindergarten through 12th grade.

The socio-economic status of the district residents
ranges from upper-lower to upper-middle class. Ninety-two
percent of the homes in the area were built within the
past ten years. Present market value of the homes in the
area range from $24,000 to $45,000.

The residents are employed, basically, as white
collar workers with semi-professional and a few professional

people residing in the school district due in part to its proximity to General Motors Technical Center. Unskilled laborers constitute only a small segment of the work force.[8]

The subjects, second grade students, were drawn from this demographic area.

Student Selection Procedure

From the existing 38 second grade classes within the Warren Woods School District, 36 second grades were randomly selected to participate in the experiment. These 36 classes were then given the Spelling section of the Stanford Achievement Test Primary II Battery, Form W.[9]

The classes were then randomly assigned to one of the four experimental treatments by a random drawing and placing the classes on a four treatment by nine classes matrix in a right to left order.

Orientation Sessions

An advance orientation session was conducted for the 12 principals of the schools involved in the experiment and a second orientation session was held one week later for the 36 participating second grade teachers. In each of the orientation sessions the experiment was explained, samples

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[8]Warren Woods Public Schools, Recruiting Handbook (Warren, Michigan: Warren Woods Public Schools, 1970), pp. 2-7.

[9]Truman Kelly, et al., Stanford Achievement Test Primary II Battery, Form W (New York: Harcourt, Brace, and World, 1964).

of the visuals were shown, and procedures carefully detailed with a following discussion period for remaining questions.

Equipment and Dates

Twenty-four identical Kodak Carousel two-by-two slide projectors, 24 screens, and 24 carts were procured. Two projectors, two screens, and two carts were placed in each school. Two complete sets of each treatment were utilized in this experiment, thus, allowing the presentation to be given to all 36 classes within the same day. The school day was divided into nine equal parts and adequate time was arranged for transportation of the materials and equipment to the respective classes. The experiment was conducted during four successive school days from the 19th through the 22nd of April, 1971. The retention test was administered to all classes one week later.

Presentation Procedure

Since the presentation procedure was identical for treatments I, II, and III, these treatments can be explained simultaneously. The three treatments described are six word--one picture (treatment I), six pictures--one word (treatment II), and one word--one picture (treatment III).

The first slide which contained the complete word in its respective pattern and the corresponding pattern of pictures was shown. The students were told by the

teacher, "I will pronounce the word--pig. Now, you pro-
nounce the word with me--pig. Now you study the word--
pig." After ten seconds, the screen then went black and
the children were told, "Write the word--pig." After ten
seconds, a corrective slide was shown and the students
were told, "If you made a spelling mistake, correct your
mistake. Try to see where you made your mistake." Each
of the three slides used per word was left on the screen
for a period of ten seconds as indicated in the pilot test.
There was a total of 20 sets used.

On the second day, the first slide of each of the
three treatments contained the word with all of its inter-
nal letters removed, thus leaving only the first and last
letters. The instructions to the students were the same
as those of the first day, with the exception that the
students were told to think how the entire word was spelled
while the first slide was shown. After ten seconds the
screen went black and the students were told to write the
word. They were then shown the correct spelling and asked
to correct any mistakes.

On the third day, the same procedure was again
followed; however, the first slide contained only the
first letter of the word. On the fourth day, all of the
letters were removed so total recall was now necessary.
This was termed the test mode. The papers were collected
and tabulated. The various configurations were dropped for
this presentation and only one picture of the object was

shown to all groups. The reason this was done was to assure the same testing mode for all the experimental groups. The students were not shown the slide containing the correct spelling of the word.

In the fourth treatment, the same techniques were followed except that a single picture was used and the spelling of the word was given orally by the teacher. Each day the amount of letters was reduced in the same manner as for the visual presentations described above. On the fourth day or the test mode, the papers were collected and tabulated.

Seven calendar days later, a retention test was given with the procedure being identical to the fourth day or test mode. These papers were also collected and tabulated.

Statistics and Instrumentation

A two-way repeated measures analysis of covariance was used to test the three main hypotheses to determine which of the four treatments was the most effective method of instruction for teaching the spelling of object words. Post hoc comparisons among treatments were performed. The unit of analysis which was utilized was the classroom mean. The covariable for this particular study was the spelling ability of the students as determined by a standardized spelling test administered prior to treatment. The independent variable consisted of the four treatments: six words--one picture (treatment I), six pictures--one word

(treatment II), paired associate or one picture--one word (treatment III), and the picture-verbal (treatment IV). The two dependent variables were the mean score on the post test immediately following the treatments and the mean score on the retention test after a duration of one week.

Hypotheses

The following null hypotheses were investigated in this study:

1-H_o: There will be no significant difference due to treatment effects.

    A. There will be no significant difference between the group receiving treatment I and all other groups.

    B. There will be no significant difference between the group receiving treatment II and the groups receiving treatment III or treatment IV.

    C. There will be no significant difference between the group receiving treatment III and the group receiving treatment IV.

2-H_o: There will be no significant difference between post test and retention test scores.

3-H_o: There will be no significant treatment by repeated measures interaction.

The design matrix is shown on the following page.

Summary

Thirty-six second grade classes at Warren Woods school district were randomly assigned to one of the four experimental configurations utilized to teach the spelling of object words. The four treatments were: six words--one

TREATMENTS

	T_1	T_2	T_3	T_4
	Six words--one picture presentation	Six pictures--one word presentation	One word--one picture presentation	Picture--oral presentation
Time 1	C-1	C-10	C-19	C-28
	C-2	C-11	C-20	C-29
	C-3	C-12	C-21	C-30
	C-4	C-13	C-22	C-31
	C-5	C-14	C-23	C-32
	C-6	C-15	C-24	C-33
	C-7	C-16	C-25	C-34
	C-8	C-17	C-26	C-35
	C-9	C-18	C-27	C-36
Time 2	C-1	C-10	C-19	C-28
	C-2	C-11	C-20	C-29
	C-3	C-12	C-21	C-30
	C-4	C-13	C-22	C-31
	C-5	C-14	C-23	C-32
	C-6	C-15	C-24	C-33
	C-7	C-16	C-25	C-34
	C-8	C-17	C-26	C-35
	C-9	C-18	C-27	C-36

picture (treatment I), six pictures--one word (treatment
II), one picture--one word (treatment III), picture--verbal
(treatment IV).

To determine the effects of the treatments on the
student's ability to learn the spelling of the selected
object words, three statistical hypotheses were generated.
These hypotheses were then tested using the two-way repeated
measures analysis of covariance. Post hoc comparisons among
treatments were then performed.

CHAPTER IV

ANALYSIS OF RESULTS

Introduction

In this chapter, the three major hypotheses are analyzed, namely that of no significant difference due to treatment effects; that of no significant difference between post-test and retention test scores; and that of no significant treatment by repeated measures interaction. As stated in Chapter III, it was intended to analyze the data using a repeated measures analysis of covariance. The reason the repeated measures of covariance was felt necessary was the capacity of this analysis to determine whether or not there was a treatment by measures inter-action, while at the same time analyzing the two remaining hypotheses, that of no difference between treatment group means on the dependent variables, and that of no difference between post-test means and the retention test means over a period of one week. However, commensurate and available alternate analytical methods were utilized to analyze the data.

In order to get the desired analysis of the hypo-thesis, the first step was to run a repeated measures of analysis of variance. This analysis gave all the information

necessary to test the hypotheses of interest to this investigation with one exception. This exception was the incorporation of the covariate or the Standardized Spelling Test scores into the analysis of treatment group differences. It was found with this analysis that there was a significant difference at the .01 level of confidence (p<.01) between the treatment effects. There was also a significant difference at the .01 level of confidence between the two measures, that of the post-test and the retention test.

There was no significant difference found when the treatment by measures interaction was analyzed. This data is shown in Table 1.

TABLE 1.--Repeated Measures Analysis of Variance.

Sources	df	SS	MS	F Ratio	
Treatment	3	260.349	86.783	5.910	(Significant, p<.01)
Measures	1	4.846	4.846	8.562	(Significant, p<.01)
T x M	3	0.630	0.210	0.374	(Not Significant p<.01)
SxT	32	469.936	14.683		
MS : T	32	18.212	0.566		
	71	753.973	107.088		

An analysis of covariance was then computed to integrate the covariate into the analysis dealing with the differences between treatment groups on the post-test. The average within group correlation coefficient of the covariate and the post-test was .749. The coefficient of the linear regression was .630. When the covariate was interjected, the significance originally found was now lost. As indicated, the analysis of covariance showed there was no significant difference between the treatment groups. The data is included in Table 2.

TABLE 2.--Analysis of Covariance on the Post-Test.

Sources	df	SS	MS	F Ratio	
T	3	6.4491	2.1497	.644	(Not Significant p<.01)
S : T	31	103.4842	3.3382		
	34	109.9333	5.4879		

A second analysis of covariance was performed to analyze the difference between treatment groups on the retention test. The average within group correlation coefficient of the covariate and retention test was 0.69. The coefficient of the linear regression for the retention test and covariate was .601. This analysis resulted in no significant difference as indicated in Table 3.

TABLE 3.--Analysis of Covariance on the Retention Test.

Sources	df	SS	MS	F Ratio	
T	3	10.2900	3.4300	0.806	(Not Significant p<.01)
S : T	31	131.9236	4.2556		
	34	142.2136	7.6856		

Tables 4, 5, 6, and 7 have been included in this section to clarify the statistical procedures used. To further help clarify the results, the hypothesis will be stated and the type and results of the analysis used to test that hypothesis will be presented following Table 7.

Table 4 shows the means and the standard deviation on the covariate for the four treatment groups. The covariate in the study was the scores received on the standardized spelling test.

TABLE 4.--Means and Standard Deviations on the Covariate.

	T_1	T_2	T_3	T_4
Means	11.94333	10.25778	15.97333	10.92778
Standard Deviation	3.05	3.17	5.96	3.79

Table 5 reveals the results on the computation of the raw means and standard deviations on the post-test for the four treatment groups.

TABLE 5.--Raw Means and Standard Deviations on the Post-Test.

	T_1	T_2	T_3	T_4
Means	13.017	11.360	15.907	11.476
Standard Deviation	2.864	3.799	1.662	2.017

Table 6 indicates the computation of the raw means and standard deviations of the retention test for the four treatment groups.

TABLE 6.--Raw Means and Standard Deviations on the Retention Test.

	T_1	T_2	T_3	T_4
Means	12.287	10.742	15.680	10.974
Standard Deviation	3.279	3.726	1.837	1.876

Table 7 shows the adjusted means for the four treatment groups on both the retention and post-test by taking into consideration how the four treatment groups did on the standardized spelling test or the covariate. The adjusted means were calculated from the following formula:

$$Y_{T.} = Y_{T.} \, b_{y.x} \, (X_{T.} - X_{..})$$

TABLE 7.--Adjusted Treatment Group Means on the Post-Test
and Retention Test.

	T_1	T_2	T_3	T_4
Post-Test	13.53	12.93	13.88	12.62
Retention Test	12.80	12.31	13.65	12.12

When this formula is written out it is as follows:
The adjusted means for treatment group T is equal to the
raw mean for group T minus the regression coefficient times
the difference between the mean on the covariate for group
T and the overall mean on the covariate for all groups.

In order to clarify the results of the different
methods of analysis which were used to test the appropriate
hypothesis, the hypotheses are restated in the Null Form
with the analysis used and the results of that analysis.

Hypothesis One

There will be no significant difference due to
treatment effects.

This hypothesis was tested using the analysis of
covariance. There was no significant difference found,
therefore the null hypothesis cannot be rejected.

Hypothesis Two

There will be no significant difference between the post-test and retention test scores.

This hypothesis was tested using the repeated measures analysis of variance. There was a significant difference found at the .01 level of confidence (p<.01).

Hypothesis Three

There will be no significant treatment by repeated measures interaction.

This hypothesis was tested using the repeated measures analysis of variance. There was no significant difference found therefore, the null hypothesis cannot be rejected.

Summary

This chapter presents the statistical analysis of the data gathered as it related to the hypotheses tested.

There were three hypotheses under investigation in this study. The first hypothesis, that of no difference due to treatment effects was found not to be significant. The second hypothesis, that of no difference between the post-test and the retention test was found to be significant at the .01 level of confidence. The third hypothesis, that of no treatment by repeated measures interaction was found not to be significant.

The fifth chapter will present the findings, con-
clusions, and recommendations of this study based on the
information from this chapter.

CHAPTER V

SUMMARY AND CONCLUSIONS

Purpose of the Study

This study was conducted in an attempt to determine
what effect the repetition of verbal and pictorial images
would have upon the achievement of second grade students in
learning to spell selected object words.

The study explored two questions: (1) Will a
visual which has repetition of verbal and pictorial images
within its framework have a positive learning effect on
the achievement of students to learn the spelling of object
words? (2) Will a visual which has repetition of verbal
and pictorial images within its framework have a positive
effect on the retention of that learning?

Design and Procedures

Thirty-six classes of second grade students from
Warren Woods School District were randomly selected to
participate in this study. The 36 classes involved a
total of 1016 students. Each of the 36 classes was then

randomly assigned to one of the four treatment groups, thus making a total of nine classes involved in each treatment.

A list of 20 words from Follett's Spelling and Writing Patterns, Book C, written by Morten Botel was compiled. Care was taken to assure that the words presented in the experiment would not have been studied in class as a regular part of the existing spelling procedure. Because of the nature of the experiment--that of visual redundancy with paired associates--only object words were chosen for presentation. Each object word and a picture of the corresponding object was photographed and used on slides in four different configurations resulting in a set of 20 slides for each of the four treatments.

The different treatments on the slides were as follows: The slides for Treatment I contained six repetitions of a single spelling word plus one picture of the corresponding object. Treatment II presented one spelling word and six identical pictures of the corresponding object. Treatment III presented one picture of the object and the corresponding spelling word. Treatment IV presented slides containing only the picture of the object with the teacher pronouncing the word as the picture was shown. The following designs indicate the word and picture placement for each of the four treatments:

Treatment I

word	word	word
	picture	
word	word	word

Treatment II

picture	picture	picture
	word	
picture	picture	picture

Treatment III

word	picture

Treatment IV

picture

The fonts and sizes of the letters in the words were consistent for all of the treatments as were the corresponding pictures. The pictures were carefully selected to present the object with no interfering contiguous matter. These pictures were photographed and processed as 35 mm slides. Each slide was shown on the screen for 10 seconds for maximum viewing without visual fatigue.

All treatments consisted of the following steps for each of the 20 words:

1. Presentation of stimulus.

2. Oral pronounciation of the word by the teacher and then by the class in unison.

3. Class attempt to write the word.

4. Correct spelling presented followed by
   student self-correction.

In the post-test and retention test, no self-
corrective technique was used. The treatment was adminis-
tered over four days using the following identical fading
technique in all four treatments for the 20 words:

Day 1. Student shown slides with complete
spelling of word.

Day 2. Student shown slides with first and
last letters of the word.

Day 3. Student shown slides with first letter
of the word.

Day 4. Student given post-test consisting of
one slide of each object.

One week later. Retention test--a replication of
the post-test was given.

A two-way repeated measures analysis of covariance
was used to test the three main hypotheses to determine
which of the four treatments was the most effective method
of instruction for teaching the spelling of object words.
The unit of analysis utilized was the classroom mean. The
covariance for this particular study was the spelling
ability of the students as determined by a standardized
spelling test administered prior to treatment. The inde-
pendent variable consisted of the four treatments: 1.
the six words and one picture treatment; 2. The six pic-
tures and one word treatment; 3. The paired associate or

one picture and one word treatment; and 4. The picture-verbal treatment. The two dependent variables were the mean score on the post-test immediately following the treatment and the mean score of the retention test given after a duration of one week.

Conclusions

Analysis of the data supports the following conclusions:

1. In comparing the relative effectiveness of six words--one picture, six pictures--one word, one word--one picture, and one picture with oral pronounciation in a slide presentation utilized to teach the spelling of object words to second grade students, no significant difference was found in the number of spelling words correctly learned by the students or retained after seven days.

2. A significant difference was found when the scores of the post-test and retention test were compared. This analysis indicates that a significant number of the words learned as a result of the treatment by the four groups was forgotten after a period of one week.

3. Analyzing the effects of treatment by repeated measures interaction, there was no significant difference found between the groups. This indicated that there was no differential treatment effects across time.

Discussion of the Results

Analysis of the data indicated that there was no significant difference among the four different treatment groups with respect to their effectiveness in teaching the spelling of object words. One of the reasons why no difference resulted may have been due to distracting elements during the presentation of the four treatments to the subjects. Observation of 15 second grade classes during the period of the experiment suggested that the classroom provided a poor environment for attentiveness on the part of the subjects. The experiment might have been more successful if individual carrels had been used thereby more efficiently focusing the students' attention on the visual stimulus. However, they are not available to all teachers and therefore this variable should be considered in further studies. The visual stimulus was the variable of interest in this study and its full impact may require a "noise" or distraction-free atmosphere for clear-cut results.

Two variables which could possibly have affected the results of the study were differences in color quality and size among the visuals presented. Although efforts were made to maintain uniform color quality some differences in intensity were present. The physical constraints of the 2x2 slide format employed restricted the relative sizes of some projected images as compared with others, particularly when multiple images were used. Projection distance was

held constant in all classrooms since all were essentially identical in dimensions. In a replication of the study it would probably be an advantage to use an overhead projector and larger screens in order to permit more standardization of the relative size of the visual images.

As indicated in the design of the presentation methods, teachers were asked to simulate as closely as possible the 10 second exposure rate of the stimulus in order to cope with the discipline problems while retaining the integrity of the timing for testing.

The significant difference found between the post-test and the retention test was not unexpected since it has been well established that people tend to forget cognitive information with the passage of time as indicated in Funda-mentals of Educational Psychology by John Travers.[1]

The interaction analysis yielded no significant difference between the treatment groups. This indicates that there was no effect on the students' mean scores resulting from differential treatment effects across time.

A pretest was not given because of the simplicity and number of the object words employed. It was judged that a pretest would sensitize students to the words listed and thus affect the results obtained in the experiment. Because a pretest was not given, however, there

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[1]John Travers, Fundamentals of Educational Psychology (Scranton: International Textbook Co., 1970), p. 216.

could be no precise determination of learning gains. While a learning gain cannot be supported statistically, a review of the mean scores on the post-test for all of the experimental groups tends to indicate, on the other hand, that positive learning did in fact occur. This is evident from the fact that the words selected for use in this study were chosen because 25 percent or less of the students in the pilot test spelled the words correctly during the word selection process. The experimental group upon completion of the treatment successfully spelled approximately 60 percent of the identical words. Because the pilot and experimental groups were similar in demographic data, the difference between these two groups' spelling achievement might be attributed to the treatment. In a future study, a set of parallel tests is suggested as a means of better ascertaining the cause and extent of such gains as might be made.

It may be worthy of note that the students in general showed enthusiasm for this kind of visual approach to the learning of spelling words. This enthusiasm was observed as the materials and equipment were brought into the respective classrooms as well as during the presentation. Especially notable was the students' approval of the immediate reinforcement which all the treatments provided after each word was presented. The teachers also expressed enthusiasm for future use of the slide presentation mode employed in the experiment because, if nothing

else, of the variety it provided as compared with their present methods in spelling instruction.

Implications for Further Research

It is suggested that the study reported here be replicated using individualized study carrels for the presentation of the visual stimulus as a means of minimizing the distracting elements experienced in the present study and that means be developed to measure gains achieved.

Another study should probably be made involving perceptual dysfunctions. A standardized test, The Frostig Development Test of Visual Perception,[2] is available to determine the perceptual problems of individual students. The use of repetitive images in learning procedures for perceptually handicapped children could conceivably provice some help for their individual needs.

It could be advantageous to record the audio portion of the presentation so as to provide a mediated self-instructional unit which could be studied for effectiveness in both initial and remediation learning. For remediation (or preventive) purposes, a set of slides could be made incorporating the concepts outlined in this study which correspond to the words given in the spelling books being used. Then, on the basis of pretests or

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[2]Mary Anne Frostig, The Frostig Developmental Test of Visual Perception (Chicago: Follett Publishing Co., 1964).

post-tests (or both) students could be given the slides
for the words spelled incorrectly. In the first case,
initial self-instruction and in the latter case remedial
self-instruction would be provided in terms of individual
needs.

It could also be advantageous to examine other
variables in replications of this study. Comparison of
achievement of students from different socio-economic and
ethnic backgrounds, and students of different mental
abilities are three elements that could be examined if
incorporated in the original design. Such factors were
not included in the present study because of the large
number of students involved and non-availability of the
information from the cooperating school system.

Also, because there were over 1000 students involved
in this study, it was not possible to restructure the
classes into experimental and control groups or to isolate
individual scores for comparative purposes. Instead means
for each classroom group were used as the basis for statis-
tical analysis with the inherent limitations of averaged
scores for individual effectiveness measurement purposes.
In a future replication of the study it is suggested that a
technique be used which will provide more analytical units
such as a random assignment of the subjects from the total
sample.

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APPENDICES

APPENDIX A

WORD SELECTION LISTS

WORD SELECTION LISTS

First List of Object Words

* 1.	animals	21.	hands
* 2.	balloon	22.	king
3.	band	*23.	kitchen
* 4.	basket	24.	lion
5.	bear	25.	map
6.	bell	26.	milk
7.	bus	27.	meat
8.	candy	*28.	monkey
9.	car	29.	penny
*10.	chimney	30.	plant
*11.	dishes	31.	pony
12.	dress	*32.	pumpkin
13.	egg	33.	ship
*14.	elephant	34.	sled
15.	face	35.	store
16.	farmer	36.	table
17.	feet	37.	top
18.	fire	38.	truck
19.	fox	*39.	wagon
20.	grapes	40.	window

*Words which 75 percent of the sample
failed to spell correctly.

Second List of Object Words

1.	arm	21.	house
2.	aunt	22.	lake
3.	barn	23.	letter
4.	bird	24.	light
* 5.	bread	25.	money
* 6.	bridge	26.	moon
7.	butter	27.	peach
8.	cage	*28.	peanuts
* 9.	clothes	*29.	people
10.	dad	30.	pie
11.	door	31.	rake
12.	ear	32.	robin
13.	eyes	33.	shoes
*14.	fairy	34.	sign
*15.	family	*35.	station
16.	flower	36.	sink
*17.	friend	37.	stove
18.	garden	*38.	suit
19.	goat	*39.	telephone
20.	hay	*40.	women

*Words which 75 percent of the sample
failed to spell correctly.

Final List of Object Words

1. animals
2. balloon
3. basket
4. bread
5. bridge
6. chimney
7. clothes
8. dishes
9. elephant
10. family
11. kitchen
12. monkey
13. peanuts
14. people
15. pumpkin
16. station
17. suit
18. telephone
19. wagon
20. women

APPENDIX B

REPORTS AND INSTRUCTIONS TO THE TEACHERS

MICHIGAN STATE UNIVERSITY EAST LANSING · MICHIGAN 48823

COLLEGE OF EDUCATION · INSTRUCTIONAL RESOURCES CENTER

February 22, 1971

Dear Second Grade Teacher of Warren Woods,

Warren Wood school district has been selected as part of an experiment in the teaching of spelling. The method used will be projected materials. It is hoped that you will be willing to participate in this experiment as the results may tend to improve the current spelling methodologies.

The procedure used will take about ten minutes of class time for a period of five days. One week later a post test will be given which should take about 15 minutes.

In order to conduct this experiment, it will be necessary to administer a standardized spelling test to all of the Second Grade students in Warren Woods. The test is enclosed and consists of only 30 words. Please administer this test as you would any standardized test. You will find the list of words, sentences and directions in this packet.

Please do not tell the children they are going to be involved in an experiment as this will effect the results of the study.

This experiment is in no way designed to evaluate your competencies as an instructor. All scores will be kept in the closest of confidence.

A report will be issued to you at the conclusion of the experiment with the experimental groups listed as a code for your own information.

The participation in this experiment has been approved by Dr. Marino. It is hoped that you will be able to participate in this experiment.

At a later date, more detailed information will be given to you regarding further procedures in the experiment.

When you have completed the administration of the exam, please return it to Dr. Marino's office. If some students are absent, do not try to give them a make-up test. You do not have to correct the tests.

Thank you,

/s/ Keith Collins
Keith Collins

tb

STANDARDIZED SPELLING TEST

Say:

ON THIS PAGE YOU ARE TO WRITE SOME WORDS. FIRST I SHALL
PRONOUNCE A WORD. NEXT I SHALL READ A SENTENCE WITH THE
WORD IN IT. THEN I SHALL SAY THE WORD AGAIN. THEN YOU
WRITE THE WORD BESIDE ITS NUMBER. LISTEN CAREFULLY, AND
BE SURE TO WRITE EACH WORD BESIDE THE RIGHT NUMBER.

(Example for Teacher) When reading the specific item list
for the form being administered, be certain to say,
"Number 1. . .," "Number 2. . .," etc.

Since the teacher reads the test, all pupils move through
the test at the same rate. The list takes approximately 20
minutes dictating time. Proceed deliberately and steadily.
Pause about 20 seconds before reading the next word and its
sentence and the second pronunciation of the word.

Test:

1.	green	The wagon was painted green.	green
2.	eats	Joe's dog eats once a day.	eats
3.	are	All of us are here now.	are
4.	from	He walked home from school.	from
5.	they	The girls say they want to go.	they
6.	told	Andy told Rough to stay home.	told
7.	very	Was it a very warm day?	very
8.	tie	Don hung his tie on the rack.	tie
9.	buy	Will father buy us a toy?	buy
10.	wash	Ann helps us wash dishes.	wash
11.	better	Is mother feeling better?	better
12.	also	Jack also has a bicycle.	also
13.	few	Only a few peaches are left.	few
14.	such	The pies were such big ones.	such
15.	front	The front door is open.	front
16.	shirt	Dave wore a red shirt.	shirt
17.	guess	Can you guess the riddle?	guess
18.	thought	Pat thought she could come.	thought
19.	flood	The rain may cause a flood.	flood

20.	orange	The <u>orange</u> was ripe.	orange
21.	slowly	Dad walked <u>slowly</u> upstairs.	slowly
22.	wrong	Cross out the <u>wrong</u> letters.	wrong
23.	grapes	Some <u>grapes</u> are sour.	grapes
24.	everybody	Will <u>everybody</u> be there?	everybody
25.	turned	Paul <u>turned</u> around.	turned
26.	dollar	The scarf cost one <u>dollar</u>.	dollar
27.	family	There are four in our <u>family</u>.	family
28.	answer	The <u>answer</u> was correct.	answer
29.	decided	We have <u>decided</u> to go home.	decided
30.	excuse	Will you <u>excuse</u> us please?	excuse

When the last word has been written, SAY

STOP! TURN OVER YOUR PAPER AND PUT YOUR PENCIL DOWN.

DIRECTIONS FOR ADMINISTERING FOUR DAY SPELLING LESSON

General Directions: The class should have paper and pencil ready each day before you begin the directions. All directions that the teacher should say to her class are <u>underlined</u>. Examples are given each day <u>for the</u> teacher to use with her class.

First Day: <u>Today you will have a short spelling lesson. Look at the picture on the screen and listen for the directions.</u>

Example:

Slide 1: <u>I will pronounce the word--pig. Now you pronounce the word with me--pig. Now you study the word pig--p-i-g.</u>

Slide 2: When the screen goes black the class will write the word. <u>Write the word pig.</u>

Slide 3: The class will correct their own paper. <u>Correct the word--pig. Look and see where you made your mistakes.</u>

<u>Now you will continue in the same way on all of the other pictures.</u>

Set 1:

Slide 1: <u>Pronounce the word--animals.</u> Have the class pronounce the <u>word after you-- animals. Now study the word-- a-n-i-m-a-l-s.</u> After the first few you need not tell them to study the word. They will do this on their own.

Slide 2: <u>Write the word animals.</u>

Slide 3: <u>Correct the word--animals. Look and see where you made your mistakes.</u>

Continue in the same manner for all slides.

Second Day: <u>Today you will see the same pictures as you did yesterday except you will only see the first and last letters of each word.</u>

Example:

Slide 1: <u>I will pronounce the word--pig. Now you pronounce the word with me--pig. The first letter is -p-. The last letter is -g-. Study the word.</u>

Slide 2: When the screen goes black the class will
write the word. Write the word pig.

Slide 3: The class will correct their own paper.
Correct the word--pig. Look and see
where you made your mistakes.

Now you will continue in the same way on all of the
other pictures.

Set 1:

Slide 1: Pronounce the word--animals. Have the
class pronounce the word after you--
animals. The first letter is -a-. The
last letter is -s-. Study the word.

Slide 2: Write the word animals.

Slide 3: Correct the word--animals. Look and see
where you made your mistakes.

Continue in the same manner for all of the slides.

Third Day: Today you will see the same pictures as you did
yesterday except you will only see the first
letter of each word.

Example:

Slide 1: I will pronounce the word--pig. You
pronounce the word with me--pig. The
first letter is -p-. Study the word.

Slide 2: When the screen goes black the class
will write the word. Write the word--
pig.

Slide 3: The class will correct their own paper.
Correct the word--pig. Look and see
where you made your mistakes.

Now you will continue in the same way on all of
the other pictures.

Set 1:

Slide 1: Pronounce the word--animals. Have the
class pronounce the word after you--
animals. The first letter is -a-.
Study the word.

Slide 2: Write the word--animals.

Slide 3: Correct the word--animals. Look and
see where you made your mistakes.

Continue in the same manner for all of the slides.

Fourth Day: <u>Today we will see how well you have learned</u>
<u>the spelling words this week. When you see</u>
<u>the picture, think of how it is spelled.</u>

Example:

Slide 1: Pronounce the word--<u>pig</u>. <u>Now think</u>
<u>of how it is spelled</u>.

Slide 2: When the screen goes black the class
will write the word. <u>Write the</u>
<u>word--pig</u>.

Set 1:

Slide 1: <u>Animals. Think of how it is spelled.</u>

Slide 2: <u>Write the word--animals.</u>

Slide 3: <u>Balloon. Think of how it is spelled.</u>

Slide 4: <u>Write the word--balloon.</u>

Continue in the same manner on all of the other pictures.

COLLECT ALL PAPERS WRITTEN ON THE FOURTH DAY.

Note: Do not attempt to teach these words to your class the
following week since a retention test must be given
at the end of the first week. The directions for the
retention test are exactly the same as the directions
for the FOURTH DAY.

PLEASE ALLOW APPROXIMATELY TEN (10) SECONDS BETWEEN SLIDES
EACH DAY.

DIRECTIONS FOR ADMINISTERING FOUR DAY SPELLING LESSON

(PICTURE ONLY)

General Directions: The class should have paper and pencil ready each day before you begin the directions. All directions that the teacher should say to her class are underlined. Examples are given each day for the teacher to use with her class.

First Day: Today you will have a short spelling lesson. Look at the picture on the screen and listen for the directions.

Example:

Slide 1: I will pronounce the word--pig. Now you pronounce the word with me--pig. Listen as I spell the word pig-- p-i-g. Now you spell it with me-- p-i-g. Now look at the picture and think of how it is spelled.

Slide 2: When the screen goes black, the class will write the word. Write the word-- pig.

Slide 3: The class will correct their own paper. I will spell the word pig and you look and see where you made your mistakes. p-i-g.

Now you will continue in the same way on all of the other pictures.

Set 1:

Slide 1: Pronounce the word--animals. Have the class pronounce the word after you-- animals. Spell the word, a-n-i-m-a-l-s. Now you spell it with me--a-n-i-m-a-l-s. Look at the picture and think of how it is spelled.

Slide 2: Write the word--animals.

Slide 3: I will spell the word and you look and see where you made mistakes. a-n-i-m-a-l-s.

Continue in the same manner for all slides.

Second Day: Today you will see the same picture as you did yesterday except I will only tell you the first and last letter of the word.

Example:

Slide 1: I will pronounce the word--pig. You pronounce the word with me-- pig. The first letter is -p-, the last letter is -g-. Now look at the picture and think of how it is spelled.

Slide 2: When the screen goes black, the class will write the word. Write the word-- pig.

Slide 3: The class will correct their own paper. I will spell the word pig and you look and see where you made your mistakes. p-i-g.

Now you will continue in the same way for all of the other pictures.

Set 1:

Slide 1: Pronounce the word--animals. Have the class pronounce the word after you--animals. The first letter is -a-, the last letter is -s-. Now look at the picture and think of how it is spelled.

Slide 2: Write the word--animals.

Slide 3: I will spell the word and you look and see where you made mistakes, a-n-i-m-a-l-s.

Third Day: Today you will see the same pictures as you did yesterday except you will only see the first letter of each word.

Example:

Slide 1: I will pronounce the word--pig. You pronounce the word with me--pig. The first letter is -p-. Study the word.

Slide 2: When the screen goes black the class will write the word. Write the word-- pig.

Slide 3: The class will correct their own paper. Correct the word--pig. Look and see where you made your mistakes.

> Now you will continue in the same way on all of the other pictures.

Set 1:

Slide 1: Pronounce the word--animals. Have the class pronounce the word after you--animals. The first letter is -a-. Study the word.

Slide 2: Write the word--animals.

Slide 3: Correct the word--animals. Look and see where you made your mistakes.

Continue in the same manner for all of the slides.

Fourth Day: Today we will see how well you have learned the spelling words this week. When you see the picture, think of how it is spelled.

Example:

Slide 1: Pronounce the word--pig. Now think of how it is spelled.

Slide 2: When the screen goes black the class will write the word. Write the word--pig.

Set 1:

Slide 1: Animals. Think of how it is spelled.

Slide 2: Write the word--animals.

Slide 3: Balloon. Think of how it is spelled.

Slide 4: Write the word--balloon.

Continue in the same manner on all of the other pictures.

COLLECT ALL PAPERS WRITTEN ON THE FOURTH DAY.

Note: Do not attempt to teach these words to you class the following week since a retention test must be given at the end of the first week. The directions for the retention test are exactly the same as the directions for the FOURTH DAY.

PLEASE ALLOW APPROXIMATELY TEN (10) SECONDS BETWEEN SLIDES EACH DAY.

MICHIGAN STATE UNIVERSITY EAST LANSING · MICHIGAN 48823

COLLEGE OF EDUCATION · INSTRUCTIONAL RESOURCES CENTER

June 18, 1971

Second Grade Teachers
Warren Woods School District
Warren Woods, Michigan

Dear Second Grade Teacher:

First, I must apologize for the delay in the issuance of
this report. The delay was caused by the pressures of
completing the school year at Michigan State University.

Secondly, I wish to express my appreciation for the excel-
lent cooperation you gave me in the conducting of this
experiment.

Thirdly, the analysis of the data collected resulted in no
significant difference between the treatment groups. This
means none of the treatments, the six words--one picture
group; the six pictures--one word group; the one picture--
one word group and the picture--oral group, did any better
on either of the examinations than any other group.

Enclosed, as I promised, are the scores on the standardized
test, the post test, and the retention test. They are not
arranged in any special order as to maintain the confi-
dentiality which was promised. These scores are for your
use in comparing the way your students performed in the
experiment with the remaining thirty-five classes.

It should be noted, however, that there was a correlation
of 0.98 between the standardized tests scores and the
results of the post and retention tests. This indicates
that they are both measuring the same thing, that of the
students ability to spell.

The scores listed are the classroom means on each of the
three examinations given. Again, thank you for your
cooperation and it was my pleasure to work with each of you
in this project.

Sincerely,

Keith M. Collins

Class	Standardized Test	Post Test	Retention Test
1	8.93	10.10	9.31
2	10.68	9.71	8.19
3	12.85	11.55	11.72
4	16.00	17.42	16.95
5	15.04	14.92	15.35
6	15.70	17.04	16.61
7	8.04	13.43	12.33
8	11.21	11.55	8.72
9	9.04	11.43	10.39
10	3.73	3.44	3.06
11	11.54	14.12	12.80
12	8.33	10.10	9.50
13	7.39	7.32	6.44
14	13.16	13.76	13.13
15	11.43	15.03	14.37
16	11.19	13.76	12.28
17	11.25	12.03	12.46
18	13.80	12.68	12.84
19	15.36	15.35	14.77
20	14.80	17.75	18.04
21	16.64	17.37	17.00
22	19.49	16.16	15.54
23	19.22	16.25	16.13
24	14.81	13.00	12.86
25	11.75	17.78	17.60
26	14.74	15.77	16.11
27	12.00	13.81	13.07
28	10.87	11.10	12.50
29	4.63	10.00	11.32
30	10.68	12.04	10.00
31	16.35	14.73	15.00
32	10.30	12.91	10.39
33	11.48	10.39	9.95
34	9.35	9.79	9.75
35	8.81	8.56	8.61
36	15.83	13.65	11.25

APPENDIX C

EXAMPLES OF VISUALS AND SLIDES FOR

EACH OF THE FOUR TREATMENTS

basket

basket

basket

basket

basket

basket

An example of the first day with six words, one picture (Treatment I).
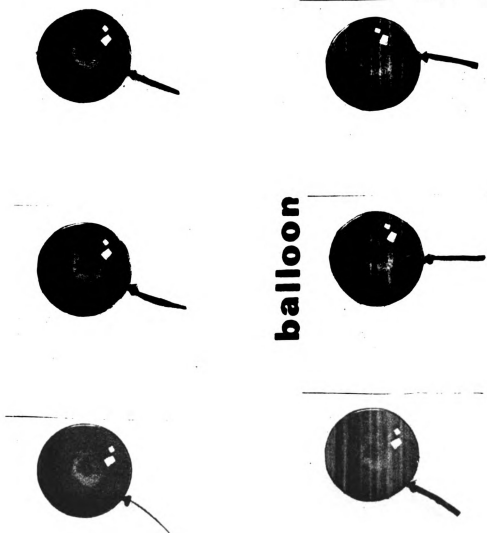
An example of the second day with six words one picture (Treatment I).

b

b

b

b

b

b

An example of the third day with six words, one picture (Treatment I).

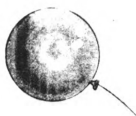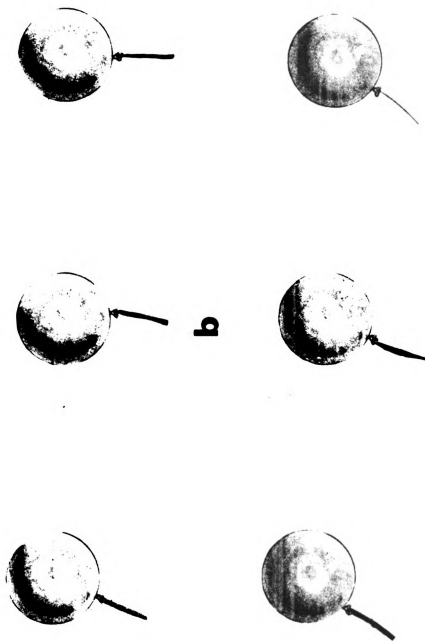An example of the fourth day with six words, one picture (Treatment I).

balloon

An example of the first day with six pictures, one word (Treatment II).

An example of the second day with six pictures, one word (Treatment II).

An example of the third day with six pictures, one word (Treatment II).

An example of the fourth day with six pictures, one word (Treatment II).

bread

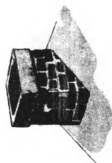An example of the first day with one picture, one word (Treatment III).

b d

b

An example of the second day with one picture, one word (Treatment III).

b

An example of the third day with one picture, one word (Treatment III).

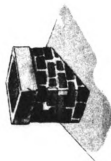An example of the fourth day with one picture, one word (Treatment III).

An example of the first day with picture-oral (Treatment IV).
Student given orally the entire spelling of the word.

An example of the second day with picture-oral (Treatment IV).
Student given orally the first and last letters of the word.

An example of the third day with picture-oral (Treatment IV).
Student given orally the first letter of the word.

An example of the fourth day with picture-oral (Treatment IV).

APPENDIX D

EXAMPLES IN SLIDE FORM OF VISUALS USED

IN EACH OF THE FOUR TREATMENTS