CHROMATIC AND ACHROMATIC PERCEPTION:  
A COMPARISON BETWEEN THE FIRST AND THIRD GRADE LEVELS

by

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STATEMENT BY AUTHOR

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July 29, 1968
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ABSTRACT

The purpose of this investigation was to explore chromatic and achromatic perception of first and third grade children from middle and low socio-economic levels. The subjects were compared with regard to the following major variables: Socio-economic level, grade level, and the chromatic and achromatic tests. The following interactions were considered: School-by-grade, test-by-grade, test-by-school, and test-by-school-by-grade. The error terms, or the error that occurs as a result of unexpected variation within the sample groupings, were calculated for the following categories: (1) Groups within each school-by-grade, (2) Test-by-group within each school-by-grade, and (3) The person-to-person variation in the experimental error.

The Pacific Picture Vocabulary Test was administered in a chromatic and achromatic form. The second test session was three weeks after the first test session.

The results of the study indicated that variations in chromatic and achromatic perception were non-significant and that more research in this area is needed.
CHAPTER 1

INTRODUCTION

Through the sense of sight, a child views the world about him. To visualize, the child employs a functional eye which receives wavelengths reflected from objects about him. The wavelengths are converted to nerve impulses and carried to the brain for interpretation. His mind attempts to understand what he has seen through a process called perception. The word, perception, is derived from the Latin word percepere which means to thoroughly grasp. When speaking of visual perception, the child's recognition and understanding of a presentation is most important.

Presentations may be prepared in a chromatic or achromatic form. Chromatic, from the Greek word chroma, refers to the presence of color; achromatic, from the Greek word achromatos, literally means without color. These two qualities of pictorial presentations were of interest because of the possibility that color or lack of color might affect the learning process.

Children are presented with a wide variety of visual stimuli in the home and classroom. Their interpretation of such data may be influenced by the chromatic or achromatic qualities. If, in fact, such
qualities do influence a child's perception, materials for their use could be prepared with perceptual abilities in mind. If they do not, then a teacher can concentrate on preparing materials that please the children and influence their learning capacities.

The question of chromatic and achromatic influences on perception was recognized while reading a report on the comparison of normal children, chronological age six, and retarded children, mental age six (Meyers, Orpet, Attwell, and Dingman, 1962). The mentally retarded children were under eighteen years of age. One of the tests they employed was the Pacific Picture Vocabulary Test which consisted of eighteen chromatic pictures for the children to identify. The influence of the chromatic qualities of the children's perception of the items illustrated was a point of investigation.

Objectives

The purpose of this investigation was to explore the chromatic and achromatic perception of children from the first and third grade levels in order to determine whether the fact of color affected their grasp of details. The subjects were compared with regard to the following major variables: Socio-economic level, grade level, and the chromatic and achromatic tests.
Main Effects

1. The schools were selected on the basis of socio-economic levels. The perceptual abilities were expected to vary because of the difference in backgrounds.

2. Maturity levels were tested by comparing test scores on the basis of grade level. The maturity factor accounted for an expected increase in perceptual ability.

3. The chromatic and achromatic qualities of the tests were the basis for testing perceptual abilities in this experiment. The chromatic test was expected to reflect higher scores since children have a broader experience base in the world of color and they have shown a preference for colored illustrations.

Interactions

The following interactions were considered on the basis of possible variation effects: School-by-grade, test-by-grade, test-by-school, and test-by-grade-by-school.

1. The school and grade interaction was to show differences between a particular school and the grade level, and the equivalent grade level within the other school. Differences in maturity and socio-economic background might well influence any variation.

2. Variations in chronological growth were explored by comparing the test-by-grade interaction. Possibly the two grade levels could
be expected to respond to each of the tests in a different manner regardless of socio-economic level.

3. The socio-economic level of the students was compared with their performance on the tests by evaluating a test-by-school interaction. This would produce an indication of the socio-economic influences on any variation that appeared.

4. The qualities of the test, the socio-economic background and the grade level of the child were taken into account by a test-by-school-by-grade interaction.

Error Terms

The error terms or those unanticipated factors which influence test performance would reveal the amount of variation from person to person within a given situation.

1. Within each class two groups were formed: One group received the chromatic test during the first test session and the other received the achromatic test during the first test session. The variation from group to group within each school and grade was computed.

2. The test-by-group within each school and class variation was to show the consistency of the test performance.

3. The error term for the entire experiment was the person-to-person variation.
CHAPTER 2

REVIEW OF LITERATURE

The Review of Literature pertains to the following topics: color vision and visual perception in children.

Color Vision

The act of seeing involves three sciences: physics, physiology, and psychology. With color vision, the three phases to be considered include the light, the eyes, and the mind. Normal color vision is trichromatic, that is, based on three primary hues. The role of the retina in the process of vision was described by Kapany (1960). The retina of the eye contains rods and cones upon which the image is formed and focused by the lens of the eye. The rods and cones have a higher refractive index than the surrounding material. The light which falls upon the rods and cones is transported through them by internal refraction. The light is then converted into visual stimulus or nerve impulses.

Rushton (1962) considered the film of a camera and the retina of the eye to be very similar. The rods and cones within the retina contain photosensitive pigments which respond to light stimulation in much the same manner as film in a camera. The rods are responsible for twilight vision; the pigment within the rods is rhodopsin or visual purple.
Within the cones, the chemicals erythrolabe and chlorolabe were found. These chemicals were measured and Rushton (1962) felt the presence of a third pigment, cyanolabe, which was responsible for the perception of blue. He was not able to measure its presence.

The theory of primary colors advocated that when the three primary colors were mixed together in varying proportions, all of the other colors would be produced. The basic primary colors were the wavelengths of red, green, and blue. The eye responded according to the degree of vibration or strength from the color source. This relates well with Rushton's (1962) theory of the three color pigments within the cone.

Land (1959) stated that all previous research had been based on the theory of primary colors. He criticized the primary color theory by stating that it did not deal with color as it was seen by the human eye. Investigations into the primary color theory had dealt with small areas of light and assumed that this would apply to all color stimulation. The study of vision in his opinion should concentrate on whole images rather than areas of colored light.

Land (1959) proceeded to experiment with complete images and two-color mixtures. On the basis of this research, he arrived at several conclusions: (a) The variation in the balance between longer and shorter wavelengths from the visual field affects color in natural images; (b) To perceive color, the eye needs information about the long and
short wavelengths being viewed; (c) Color in the natural image is affected by the random interplay of longer and shorter wavelengths over the complete visual field; (d) The light rays are not the color but are bearers of information which is used by the eye to assign colors to the objects within an image.

Pastore (1960) and Geschwind and Segal (1960) conducted experiments similar to Land's (1959) research with regard to color vision. Pastore (1960, p. 168) concluded "... the interaction of long and short wavelengths which results in the perception of color occurs in the brain, and not in the eye."

Geschwind and Segal (1960, p. 608) reached similar conclusions by stating "... the perception of colors of all hues from two-color mixtures cannot be a purely retinal effect, but must involve the interaction of higher centers."

Each of these studies (Geschwind and Segal, 1960; Pastore, 1960; Land, 1959) seemed to reinforce one another. These were in direct contrast to the primary color theory. The use of two-color mixtures provided a complete range of color to be viewed by the human eye. Color vision seemed to depend upon a higher process in the brain.

Land and Daw (1962) conducted a later experiment which influenced the previously stated conclusion. This experiment was conducted along the basic line of Land's (1959) original research. The results, however, were not identical. The conclusion reached by Land and Daw (1962)
mentioned a process of the retina, not of the cerebral cortex, as a basic factor in color vision. The contrasting views indicate a need for more research into the process of color vision.

Visual Perception in Children

Visual perception has been approached from many different points of view. For Ittelson and Kilpatrick (1951) perception was always subject to variation. The interpretation given to a viewed object depends upon experiences which make the object recognizable to the mind.

According to Gesell, Ilg, and Bullis (1949), visual development in children proceeds from the general to the specific. The child at age three can effectively look back and forth from a model to a task. He is interested in landmarks as he walks from place to place and shows a beginning awareness of the "wholeness" of the world. At ages four and five, his visual-motor activity is freer and the child begins to isolate details without losing awareness of the wholes to which they belong. The eyes become more expressive and continue to develop through ages six and seven. By age eight, the child is much more observant and is beginning to see the world as a whole.

Vernon (1958) found that young children failed to notice details in pictures, but did perceive the clearly essential aspects of shapes. Stevenson and McBee (1958) found that preschool children make form discriminations more easily if the forms are solid cutouts than if they
are simply printed on paper. Evans (1949) also expressed the view that complex seeing was based on form recognition. This recognition of form preceded the recognition of color. Kagen and Lemkin (1961) supported these conclusions by stating that children discriminate differences in form before differences in color.

Gradually color becomes important to the young child. Lowenfeld and Brittain (1964) described the preschematic stage, ages four to seven years, as a period when the child has no desire for "direct" color relationships in his art work; color is used for color's sake, not for realism. During the schematic stage, age seven to nine years, the child discovers a relationship between the color and the object.

Many studies have been conducted dealing with color naming responses (Cook, 1931; Garth and Porter, 1934; Synolds and Pronko, 1949) which conclusively prove that children are more able to name and discriminate among colors as their chronological age increases. Hurlock and Thomson (1934) state that between the ages of four-and-a-half and eight-and-a-half, inclusively, the ability to perceive accurately and in detail shows a constant relationship to chronological age. This relationship to the age factor is stronger than the relationship to intelligence.

Perception of pictures is very different from the perception gained from empirical observation. In a sense, the object is viewed secondhand; the eye interprets an interpretation of an object. Pirenne
(1967) noted that a person is aware of the shape of a painted or printed surface and of its relative position to the eyes. The surface is flat, yet artists and pictures make use of shading and perspective to give the illusion of depth. Miller (1938) investigated children's awareness of pictures and found that children of eight or nine years could describe about twenty per cent of the main items in pictures taken from school textbooks.

In a color versus non-color picture preference experiment, Rudisill (1952) discovered that seventy to eighty per cent of all the children studied, kindergarten through sixth grade, voted for colored pictures in statistically reliable majorities. She (Rudisill, 1952, p. 451) stated, "If two pictures are identical in all other respects, most children prefer a realistically colored one to an uncolored one."

Summary

Children's preference for chromatic pictures has been shown; the perception of details within a picture was questioned. Children note form before color, but an outline of an object, for the child, is not sufficient in a picture to really reveal what the object is. The individual must have experienced the object and made it a part of his personality. Hirsch and Wick (1963, p. 101) state, "Cognition has to do with 'knowing'. Perceiving involves an expression of knowing."
Children are exposed to a wide variety of visual stimuli. Presentations may be prepared in a chromatic or achromatic form. The child will view this presentation and interpret its content on the basis of his experiences. His perception may be influenced by its chromatic or achromatic qualities. Research into this aspect of children's visual perception has been minimal; further investigation is indicated.
CHAPTER 3

PROCEDURE

The basic testing procedure outlined by Meyers, Orpet, Attwell, and Dingman (1962) for the Pacific Picture Vocabulary Test was used in this investigation. Minor adaptations were made to meet the needs of this specific experiment. The desire for more specific information about chromatic and achromatic perception has been illustrated by the investigator in the review of literature.

Selection of the Subjects

The subjects of the present study were drawn from two schools within Tucson School District No. 1, Tucson, Arizona. The schools were selected by Dr. Charles Grubbs, Coordinator of Testing for the district, as being representative of middle and low socio-economic populations. Schumaker School was designated a middle-class elementary school by the principal, Mr. Bruce Patrick. The Title II poverty basis of Davis School was reiterated by the principal, Mr. Sam Poleto.

The children were selected from available classrooms at Davis and Schumaker Schools. Many of the students, particularly at Davis

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1. The age and sex of the subjects may have introduced an added factor, but due to the complexity of analysis, the factors could not be computed at this time.
School, were involved in other studies. Consequently, the available population was limited. Ninety-six children, forty-eight from each school, twenty-four from the first and third grade levels at each school, participated in the study.

This experiment represents a mixed model. The schools, the grades, and the tests were fixed; the selection of pupils and their later grouping were entirely at random.

**Collection of Data**

The Pacific Picture Vocabulary Test consisted of eighteen colored pictures of common objects and situations, yielding a fifty-nine word test. The pictures were taken from the Bryngelson and Glaspey Speech Improvement Cards, Set B, 1951, published by Scott, Foresman and Company, and obtained from Dr. R. Orpet, California State College at Long Beach. The pictures in the test were used in the following order: 123, 127, 61, 124, 63, 80, 31, 141, 106, 110, 93, 78, 75, 74, 44, 140, 62, and 11. The achromatic set of cards was prepared by photographing the colored pictures. The subject or pupil was required to name the objects or processes pointed to in a designated picture. The responses were recorded on an answer sheet (Appendix).

The experimenter elicited the test words indicated on the answer sheet by asking such questions as, "What is this?" "What are these called?" "What is the boy doing?" etc., while pointing to the desired
object or action depicted. Verbal or behavioral clues were not given. Borderline responses were questioned neutrally; for example, if the subject responded that the handle of the hammer is wood, the experimenter's response was, "Yes it is made out of wood--but what do we call this part of the hammer?"

When a response was queried, the letter (Q) was recorded with the subject's response following. If the subject's response was the same as the keyed response (in capital letters on the answer sheet), only a plus (+) was recorded in the space to the left of the item. All other responses were written in the space to the right. If the subject did not respond with the correct answer after much questioning, a minus (−) was recorded. The total number of correct items was computed for the final score.

The experimenter was familiar with the scoring criteria before administering the test. There was no time limit established.

The Pacific Picture Vocabulary Test was administered twice to all of the children; once in the chromatic form and once in the achromatic form. Twelve of the children in each grade level at each school received the chromatic test during the first test session. The remaining twelve students in each class at each school received the achromatic version. Three weeks later, the children were administered the opposite test. The assumption was made that no learning would have occurred in the previous testing situation.
Treatment of Data

The data in this study were evaluated on the basis of two variance analysis techniques: single-classification analysis and multiple-classification analysis. The purpose of the statistical analysis was to determine the significance of mean differences between factors. There were certain assumptions underlying the use of these techniques which had to be satisfied.

One assumption of analysis of variance was that the measures within each category or subgroup were representative of random populations. In this study, there was approximate randomization of subjects.

The other major assumption of analysis of variance was that the variances within the subgroups were homogeneous, that is, not significantly different among one another. This assumption was not tested; the data were analyzed on the basis that homogeneity existed.

The object of the analysis was to obtain an F value by which the significance of the scores could be interpreted. By using the table of F, the significance of the F value obtained was determined at the 0.05 level. If this value was equal to or larger than the tabled values of F, the obtained F value was considered statistically significant. If it was less than the tabled value, the obtained F value was considered nonsignificant.

The major variables in this experiment were the tests, the schools and the classes. Other variables, including socio-economic
level, grade or class within a particular school, and chronology of test, were evaluated because of their relationship to the criterion variables under consideration. These factors were tested by the size of the F value and interpreted for significance from the table of F as previously described.

Table 1 illustrates the expected mean squares in this experiment. The expected mean square determines the numerator and denominator when computing an F value.
<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Expectations of Mean Squares</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>1</td>
<td>$\sigma^2 + 96 \theta_s$</td>
</tr>
<tr>
<td>Grade</td>
<td>1</td>
<td>$\sigma^2 + 96 \theta_g$</td>
</tr>
<tr>
<td>School-by-Grade</td>
<td>1</td>
<td>$\sigma^2 + 24 \sigma^2_{G/sg} + 48 \theta_{sg}$</td>
</tr>
<tr>
<td>Groups within each School-by-Grade</td>
<td>4</td>
<td>$\sigma^2 + 24 \sigma^2_{G/sg}$</td>
</tr>
<tr>
<td>Test</td>
<td>1</td>
<td>$\sigma^2 + 96 \theta_T$</td>
</tr>
<tr>
<td>Test-by-Grade</td>
<td>1</td>
<td>$\sigma^2 + 48 \theta_{Tg}$</td>
</tr>
<tr>
<td>Test-by-School</td>
<td>1</td>
<td>$\sigma^2 + 48 \theta_{Ts}$</td>
</tr>
<tr>
<td>Test-by-Grade-by-School</td>
<td>1</td>
<td>$\sigma^2 + 12 \sigma^2_{(T\times G)/(s\times g)} + 24 \theta_{Tgs}$</td>
</tr>
<tr>
<td>Test-by-Group within each School-by-Grade</td>
<td>4</td>
<td>$\sigma^2 + 12 \sigma^2_{(T\times G)/(s\times g)}$</td>
</tr>
<tr>
<td>Error</td>
<td>165</td>
<td>$\sigma^2$</td>
</tr>
</tbody>
</table>

$\sigma^2 = \text{variance}$

$\theta$ refers to the amount of variation due to the factor
CHAPTER 4

RESULTS

The total number of correct responses made by the children in the study were tabulated and then interpreted on the basis of the table of F, a distribution of variances. Table 2 is a compilation of the total results of this study. Each objective was interpreted on the basis of significance in the table of F.

Main Effects

The mean scores of the two schools varied slightly. The differences that appeared were judged non-significant by the table of F as shown in Table 2, item 1.

Grade-level differences in mean scores were minimal. The apparent differences could have occurred by chance as was indicated by the table of F in Table 2, item 2.

The differences between the mean scores with regard to the chromatic and achromatic tests were judged non-significant according to the table of F as shown in Table 2, item 5.

Interactions

The differences in mean scores between middle and lower socio-economic schools and first and third grade from these schools,
TABLE 2. Comparison of the results from the study of chromatic and achromatic perception of first and third grade children from middle and low socio-economic levels.

<table>
<thead>
<tr>
<th>Item</th>
<th>Source of Variation</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F (&lt; 0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>School</td>
<td>1</td>
<td>0.083333</td>
<td>&lt;1 n.s.</td>
</tr>
<tr>
<td>2.</td>
<td>Grade</td>
<td>1</td>
<td>72.520833</td>
<td>&lt;1 n.s.</td>
</tr>
<tr>
<td>3.</td>
<td>School-by-Grade</td>
<td>1</td>
<td>10.083333</td>
<td>&lt;1 n.s.</td>
</tr>
<tr>
<td>4.</td>
<td>Groups within each</td>
<td>4</td>
<td>36.468750</td>
<td>&lt;1 n.s.</td>
</tr>
<tr>
<td></td>
<td>School-by-Grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Test</td>
<td>1</td>
<td>0.083333</td>
<td>&lt;1 n.s.</td>
</tr>
<tr>
<td>6.</td>
<td>Test-by-Grade</td>
<td>1</td>
<td>52.083333</td>
<td>&lt;1 n.s.</td>
</tr>
<tr>
<td>7.</td>
<td>Test-by-School</td>
<td>1</td>
<td>1.187500</td>
<td>&lt;1 n.s.</td>
</tr>
<tr>
<td>8.</td>
<td>Test-by-School-by-Grade</td>
<td>1</td>
<td>1.020833</td>
<td>&lt;1 n.s.</td>
</tr>
<tr>
<td>9.</td>
<td>Test-by-Group within each School-by-Grade</td>
<td>4</td>
<td>64.093750</td>
<td>&lt;1 n.s.</td>
</tr>
<tr>
<td>10.</td>
<td>Error</td>
<td>165</td>
<td>76.764394</td>
<td></td>
</tr>
</tbody>
</table>
considered as one factor, were not large enough to be considered significant as indicated in Table 2, item 3.

The variations in mean scores that occurred between the first and third grade levels in the chromatic and achromatic tests were slight. These differences were not large enough to be significant.

The influence of socio-economic backgrounds of the student's performance on the chromatic and achromatic tests was shown in Table 2, item 7. The differences were non-significant.

The test-by-school-by-grade interaction was also non-significant.

Error Terms

The variation from group to group within each school and grade was non-significant as shown in Table 2, item 4.

The test-by-group within each school and grade variation was non-significant as shown in Table 2, item 9.

The error term for the entire experiment is shown in Table 2 item 10.

A coefficient of variation factor was computed as a reflection of the variation from person to person within the experiment. This is a relative measure of the validity of a study. The coefficient of variation should fall within a range of five to ten per cent; in this study, it was computed at 19.33 per cent.
CHAPTER 5

SUMMARY AND CONCLUSIONS

The expected outcomes in terms of the objectives proved to be non-significant. The chromatic and achromatic qualities within the test presentations, the socio-economic background of the children, the grade level, and the grouping within each class did not seem to have a significant influence on the perceptual abilities of children from the first and third grade levels.

However, the large error term was a major factor in producing the non-significant results. The variation from person to person was greater than any other variation within the experiment. The error term could be reduced by any of the following methods: (a) More classes within one school could be chosen to increase the grade variation and eliminate the school variation; (b) Concentration on one grade level within a larger number of schools could increase the school factor and decrease grade variation; (c) An increase in the number of test treatments could produce similar variations that could change the results of the study. These innovations would also vary the degrees of freedom needed to enter the table of F. The larger the degrees of freedom, the smaller the F value needed for significance.
Inasmuch as the non-significant results in the present study might well have been derived from the utilization of too small a sample which resulted in a large error factor, future studies might possibly yield significantly different results in color perception. The importance of this possibility would seem to be indicated by the critical nature of perceptual behavior in the preschool period. Conceivably, significant findings might affect the format and presentation of visual learning media in the preschool period.
APPENDIX A

ANSWER SHEET

Name ___________________   School ___________

Last First

Chromatic Test___________ Achromatic Test__________

Test Date: Yr____ Mo____ Day_____ Sex: M  F  Score___
Birthdate: Yr____ Mo____ Day_____ 

123

HAMMER ____________________________ (no other)
NAILS ____________________________ (brads)
BOARD ____________________________ (wood, lumber)
HANDLE ____________________________ (no other)
HEAD ____________________________ (no other)

127

TREE ____________________________ (no other)
TRUNK ____________________________ (no other)
BRANCH ____________________________ (limb)
LEAVES ____________________________ (foliage)

61

BOY (Who's that?) ____________________________ (boy, child)
HAIR ____________________________ (head)
WHAT IS THE BOY DOING? ____________________________ (brushing or combing his hair, no other)
MIRROR ____________________________ (looking glass)
IMAGE ____________________________ (credit only image or reflection, question "himself, his arm, etc." by asking, What do we call anything that you see in the mirror?)

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FOOT ____________________________ (shoe, slipper, boots, rubbers, galoshes)
UMBRELLA (parasol)
COAT (raincoat, jacket)
WHAT IS THE GIRL DOING? (general idea of walking in the rain)

CLOCK (no other, do not credit watch)
WHAT IS A CLOCK USED FOR? (general idea of indicating time) NUMBERS (figures) HANDS (no other)

HOUSE (house, building, home, ward, hospital)
DOOR (no other)
ROOF (no other, question "top of the house")
CHIMNEY (smokestack; question "fireplace")

LADDER (no other)
WALL (fence; question "brick" by saying "Yes, these are bricks, but what do we call this?")

WATCH (wrist watch; do not credit clock)
BAND (strap; do not credit belt)
BUCKLE (no other)

THERMOMETER (no other, do not credit temperature)
WHAT IS IT USED FOR? (credit an expression of idea of indicating how hot or cold or what temperature is)

CALENDAR (no other)
WHAT IS IT USED FOR? (credit any expression of telling month, day, week with it; not "time")

GATE (no other, do not credit door)
WALK (sidewalk, path)
FLOWERS (credit names of specific flowers if at all possible)
PICKETS (pickets: no other; question "boards" with "What do we call the boards with points on them?")

APPLE(S) (tomato-es)
BANANAS (no other)
Pears (no other)
GRAPES (no other)
FRUIT (credit only fruit or fruits)
(ask: "What is one word that all of them are called? What are they all called?")

FLY (no other; question "insect")
SCREEN (netting; question "wire")

WATER (no other)
WHAT IS THE WATER DOING? (squirting; spout-ing; spray-ing; eject-ing) (motion with pencil)

FLAG (no other)
POLE (post, staff, standard; question "mast")
PITCHER (no other)
BACON (no other; question "food")
EGG(S)________________________(no other)
YOLK___________________________(no other; credit "olk" only if S has demonstrated trouble with initial "y")

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CARROT(S)____________________________(no other)
TOMATO(ES)___________________________(apple-s; no other, unless a fruit known to be as round and red is named, which is unlikely)

BASKET____________________________(picnic basket; do not credit but question "basket")

VEGETABLE(S)________________________(credit food, vegetables, things to eat)
(ask: "What is the one word that all of these are called? What do you call all of them?") (motion generally with pencil)

CELERY____________________________(no other)

Totals:
Card 123____ 124____ 31____ 110____ 75____ 140____
127____ 63____ 141____ 93____ 74____ 62____
61____ 80____ 106____ 78____ 44____ 11____

Total:________________
LIST OF REFERENCES

Bryngelson, B. and Glaspey, E. 1951 Speech Improvement Cards, Set B. San Jose, California: Scott, Foresman Co.


Evans, Ralph M. 1949 Seeing light and color. Scientific American; vol. 180, pp. 52-55.


