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A Study of the Tachistoscope in Teaching Rhythmic Sight-Reading.

Terry Olean Wright
Louisiana State University and Agricultural & Mechanical College

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A STUDY OF THE TACHISTOSCOPE IN TEACHING RHYTHMIC SIGHT-READING

The Louisiana State University and Agricultural and Mechanical Col. Ph.D. 1982

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A STUDY OF THE TACHISTOSCOPE
IN TEACHING
RHYTHMIC SIGHT-READING

A Dissertation
Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in
The Interdepartmental Program in Education

by
Terry Olean Wright
B.S. Mississippi State University, 1965
M.Ed. Mississippi State University, 1966

December 1982
In memory of my father

Olean Wright
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ABSTRACT

The main problem investigated in this study was: does the use of the tachistoscopic technique result in greater rhythmic sight-reading performance than conventional methods among junior high music students? A subordinate problem investigated was: does the location of the image in the visual field in the upper left hand corner result in greater rhythmic sight-reading performance than conventional image locations among junior high music students?

Subjects for the study consisted of 86 sixth grade music students enrolled at Denham Springs Junior High School, Denham Springs, Louisiana. The Watkins-Farnum Performance Scale (Parts A and B) comprised the test instrument. The design of the study was a 2 x 2 factorial, with subjects randomly assigned to existing classes.

After a pretest was administered, slides of rhythm patterns were shown to the four groups. Each group received a different treatment, in which both image duration and image location were varied. A posttest was administered and the results analyzed, using two computer analysis systems.

The findings indicated that there was no significant difference in rhythmic sight-reading performance among any of the groups, whether duration was conventional or
tachistoscopically presented, or whether image location was
conventional or located in the upper left hand corner of
the screen.

ANOVA and ANCOVA were employed in data analysis, and
none of the F-values was significant at the .05 level. All
of the null hypotheses were accepted. Within the
limitations of this study, the results were interpreted as
an indication that, despite previous research, the use of
the tachistoscopic technique, while effective in
language-reading, is not significantly better than
conventional means of rhythmic sight-reading instruction in
music-reading.
CHAPTER 1

INTRODUCTION

The major goal of instructional technology is the improvement of learning. This technology calls upon the resources of both humans and machines. An instructional technology definition, which goes beyond any particular medium or device, summarizes current thinking on the matter:

It is a systematic way of designing, carrying out and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication, and employing a combination of human and nonhuman resources to bring about more effective instruction (Tickton, 1970:21).

Due to the very subjective nature of musical performance evaluation, the formulation of specific learning objectives has not been as widely emphasized in music as in other disciplines. This lack has led to a wide variety of teaching methods and techniques, often without the advance specification of objectives.

Representatives from the Educational Testing Service met with a group of music experts in order to develop music objectives and to define the scope of musical assessment.
Their study, published under the supervision of the National Assessment of Educational Progress (NAEP), listed several objectives (Norris and Bowes, 1970):

1. perform a piece of music
2. read standard musical notation
3. listen to music with understanding
4. be knowledgeable about musical instruments
5. seek musical experiences
6. make judgements about music

Implicit in the ability to perform music is the ability to read music at sight. The ability to read music at sight is dependent upon the performer's ability to read rhythms, and the ability to perform rhythms accurately and independently is necessary in order to read music at sight (Doerksen, 1972).

Following the publication of the six musical objectives by the NAEP, that group surveyed performance abilities of musicians of various ages. Among all ages surveyed, very few individuals were able to accurately sight-read a line of music (NAEP, 1974).

Some music educators and reading instructors believe that a correlation or similarity of learning processes exists between learning to read words and learning to read music. Research indicated that the teaching of music-reading skills may contribute to language-reading skills (Movsesian, 1969; Zinar, 1976; Lloyd, 1978).

The correlation of processes involved between
language-reading skills and music-reading skills was investigated by several researchers with the conclusion that there is a correlation of processes between the two (York, 1952; Monroe, 1967; Stern, 1972; Debban, 1977).

Numerous research studies compared audiovisual methods with non-audiovisual methods of teaching. This research ranged from tape recordings of reading passages to aid comprehension (Hall, 1976), to total multi-media approaches (Heflin and others, 1968). Early studies investigated the effects of machines such as the tachistoscope and 16mm films (Glock, 1955; Greenwald, 1972), while other research involved several innovations in teaching machines in the study of reading, for example, the Aud-X, Tach-X, and the Controlled Reader (Brickner and Senter, 1969; Palmatier, 1971).

Throughout the history of the use of machines to teach reading and other subjects, some researchers concluded that teaching machines offered no significant gain over traditional methods. Therefore, these devices were not worthy of investment (Berger, 1969; Whittaker, 1971).

Industry, however, has adopted several versions of teaching machines, including the computer, in an effort to improve performance of employees. Research indicated that industrial leaders do not make such decisions without a great consideration for financial and logistical considerations, and the trend has been to call upon technology to fulfill an existing need, rather than to
begin with the technology itself (Roberts and Rankin, 1981). Jones (1956) reported on the use of controlled reading devices to improve the reading ability of executives. The tachistoscope has also been used in attempts to improve shorthand technique (Barber, 1961), typing skills (Hille, 1977), and spelling achievement (John, 1973).

A pioneer combination of the technique of tachistoscopic flashing combined with learning theory in reading took place when CBS-TV and Northwestern University presented a tachistoscopic challenge to the viewing audience, based upon the assumption that the average person should be able to grasp fourteen words of pica type within the span of a half-dollar. The switching capabilities of the television station were used to create a flashed image, followed by questions designed to measure audience comprehension (Schale, 1971).

Music education followed a similar path toward the use of audiovisual machines to improve learning efficiency. Vasil (1968) developed materials in an effort to promote an audiovisual approach to music education. He cautioned against misuse, but advised that such an approach has its greatest value in allowing for variety. The earliest efforts toward an audiovisual approach toward solving music educators' problems involved the use of very simple devices, such as the metronome (Trismen, 1964). Later research advocated the use of automated machines, such as
those designed to monitor rhythmic accuracy (Ihrke, 1969). Manzanares (1969) conducted research using a controlled reading device to improve sight-reading ability, while Houston (1963) used a reading accelerator in an effort to improve piano sight-reading ability.

The tachistoscopic presentation technique was used by Hammer (1961) in a study to determine the effect of tachistoscopic training upon the development of melodic sight-singing ability. His general findings and conclusions were in favor of the device, but he recommended a great deal of further study into the use of that technique. Bargar (1964) recognized the parallels between learning theory in reading and learning theory in music-reading, and also used the tachistoscope in further research concerning music-reading skills.

Research on the use of controlled reading devices as an aid in developing musical sight-reading skills has thus far been concerned with either tonal sight-reading ability, or upon music-reading in general. There has been very little research on the use of the tachistoscope to teach pure rhythmic sight-reading skills, and this author was unable to locate any research which dealt specifically with the use of the tachistoscope as a method of developing rhythmic sight-reading skills among subjects of junior high age. Some research has been conducted upon the use of the tachistoscope in teaching music-reading, but the emphasis was either on melodic skills, or it involved ages older
than junior high school. Some of the existing research concerning the use of this technique in music-reading research involved the use of samples which were so small that the generalizibility of the study was severely limited.

To provide background information and a frame of reference for studying the effect of the method under consideration, the review of the literature examined:

1. learning theory as it applies to reading research
2. research concerning the use of the tachistoscopic technique in teaching reading
3. theories concerning the relation of language reading skills to music-reading skills
4. research concerning the use of the tachistoscope in music-reading.

Statement of the Problem

The problem under investigation was whether the use of the tachistoscopic technique aids in the development of rhythmic sight-reading ability in junior high school music students. This problem was studied in terms of the following variables:

1. duration of the image
2. location of the image

The present study was concerned with the following questions:

1. Is there a significant difference in rhythmic
sight-reading performance between subjects taught using the tachistoscopic technique and those taught by conventional means?

2. Is there a significant difference in rhythmic sight-reading performance between subjects taught using an upper-left-hand item position and those taught using a normal item position?

3. Is there a significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with the normal item position and subjects taught using the tachistoscopic technique with an upper-left-hand item position?

4. Is there a significant difference in rhythmic sight-reading performance between subjects taught by conventional means with a normal item position and subjects taught by conventional means with an upper-left-hand item position?

5. Is there a significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with a normal item position and subjects taught by conventional means with a normal item position?

6. Is there a significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with an upper-left-hand item position and subjects taught by conventional means with an upper-left-hand item position?
7. Is there a significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with a normal item position and subjects taught using conventional means with an upper-left-hand item position?

8. Is there a significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with an upper-left-hand item position and subjects taught by conventional means with a normal item position?

Hypotheses

Hypothesis One: There is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique and those taught by conventional means.

Hypothesis Two: There is no significant difference in rhythmic sight-reading performance between subjects taught using an upper-left-hand item position and those taught using a normal item position.

Hypothesis Three: There is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with a normal item position and subjects taught using the tachistoscopic technique with an upper-left-hand item position.
Hypothesis Four: There will be no significant difference in rhythmic sight-reading performance between subjects taught by conventional means with a normal item position and subjects taught by conventional means with an upper-left-hand item position.

Hypothesis Five: There is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with a normal item position and subjects taught by conventional means with a normal item position.

Hypothesis Six: There is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with an upper-left-hand item position and subjects taught by conventional means with an upper-left-hand item position.

Hypothesis Seven: There is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with a normal item position and subjects taught by conventional means with an upper-left-hand item position.

Hypothesis Eight: There is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with an upper-left-hand item position and subjects taught by conventional means with a normal item position.
Definitions

**Accelerator**

A device which controls the rate of visually presented material, designed to increase the speed at which the learner processes information.

**Array**

The size of the visual field.

**Aud-X**

The brand name of a controlled reading device.

**Brain hemispheric specialization**

The tendency for different halves or hemispheres of the brain to perform certain tasks in a specialized, but non-exclusive, manner.

**Cathode ray tube**

Computer screen; television screen.

**Controlled reader**

A machine in which the pace of presentation, the duration of the image, or both are varied.

**Controlled time exposure**

The process of controlling the amount of time an image is presented to the viewer by any of a number of means.

**Crossed dominance**

Tendency in certain individuals for some brain functions to be performed in a non-standard manner.

**Electroencephalographic**

A procedure whereby brain impulses are electronically...
monitored using electrodes attached externally to a subject's head.

**Encoding**

Part of the processing of information by the brain.

**Eye span**

The size of image or physical array which the eye sees.

**Fixation**

The stoppage of the eye during intake of visual information.

**Harmonic**

Musically speaking, related to the combination of two or more tones simultaneously.

**Hemi-field**

One half of the visual field.

**Hippocampus**

That part of the brain associated with novelty.

**Iconic**

Related to image storage.

**Latent Image**

The previous image, as it persists on the retina of the eye.

**Melodic**

Musically speaking, involving different tones.

**Notation**

In music, the notes and related symbols.
Pitch
In music, the frequency of tones.

Regression
The reversal of eye movement.

Rhythmic
Musically speaking, involving only the duration of tones, and not the pitch.

Sight-reading
In music, the procedure of performing a piece of music without the benefit of prior rehearsal.

Tachistoscope
A device used to control the duration of an image using a shutter mounted on a lens.

Tachistoscopic
The technique of varying the duration of an image

Tach-X
The brand name of a controlled reading device.

Target
The current image.

Assumptions

Assumptions of this study included the following:
1. There were no extreme differences in pre-entry musical skill of subjects in the groups being tested.
2. That all subjects possessed learning capacities within normal limits.
3. That the techniques of the instructor in each of
the groups did not differ except in those areas that called for a distinction in treatments.

Limitations

1. The subjects for this study were randomly selected insofar as the availability of the designated population allowed.

2. Experimenter variables may have accounted for any differences which may have been found.

3. The fact that treatments were offered at different times during the day may have affected the findings.

4. The results of the study were generalizable only to subjects with similar characteristics within the population.

Significance of the Study

The idea that technology may meet instructional needs played an important role in the selection of this research project. Music education has long had an unfilled need: the need for an efficient method of teaching rhythmic sight-reading to developing music students. Because of the subjective nature of music itself, music educators have been reluctant, until the most recent past, to bring into play those instructional techniques which attempt to codify the discipline.

Previous experiments which used tachistoscopic techniques have not specifically concentrated upon the
topic of rhythmic sight-reading instruction with an age group which has been shown to be in the middle of a brain growth period, at least not with a sample of significant size. The effect of item position variation on the image field has also not been researched in music.

The lack of data available on the information processing ability of such subjects utilizing the techniques mentioned above is evidence for research in this area as a means of establishing possible instructional practices in the area of sight-reading instruction.

Treatment of Data

Data collected for this research consisted of raw scores on the Watkins-Farnum Performance Scale, Part A, which was administered as a pretest, and raw scores on the Watkins-Farnum Performance Scale, Part B, which was administered as a posttest. Mean scores were computed for each cell, for the two groups who received tachistoscopic treatment, for the two groups who received conventional exposure, for the two groups who received the upper-left-hand item position, and for the two groups who received the conventional item position.

Analysis of variance was computed for the pretest and posttest, and analysis of covariance was computed for the posttest, using the pretest as the covariate. Hypotheses were tested at the .05 level of confidence.
CHAPTER 2

REVIEW OF RELATED LITERATURE

Research in learning theory has provided a great deal of insight regarding the process of teaching reading. Factors such as age, sex, socio-economic background, heredity, environment, intelligence, health, and others have also been investigated for their effects upon the learner. Other specific factors regarding the actual mechanics of reading and the use of controlled reading techniques contribute to the problem. These factors include, but are not limited to, expectancy, stimulus familiarity, prompting, cues, image duration, illumination, array size and eye span (horizontal and vertical), item position within the image field, masking, and hemispherical (lateral) dominance. Research involving the reading process, whether it be language reading or music reading should take these factors into account. Investigations regarding the use of controlled reading devices, and/or the tachistoscopic presentation of stimuli must be based upon a thorough knowledge of the influence and effect of the factors listed above.
Age

Information processing may be considered to be developmental in nature, and, consequently, adults process information in a more efficient manner than children. Additionally, older children process information more efficiently than younger children or infants (Chi, 1977; Lasky and Spiro, 1980). The initial capacity for intake of visual information does not change developmentally, but developmental differences in visual memory occur temporally at later stages in the processing sequence (Sheingold, 1973).

One of the important developmental differences is in the perceived duration of images. Avant and others (1977) investigated the developmental theory and concluded that contact between stimulus inputs and memory representations must precede allocation of attention by the learner to the stimulus itself. Since children have less short term memory from which to draw, coding is thus less efficient in children than in adults. The difference in recognition lies not in the capacity for intake of visual information between children and adults, but instead in the encoding process itself (Blake and Vingilis, 1977; Huba and Vellutino, 1980). Iconic, or image, storage is longer in young children than in older children or adults, but the information in iconic storage is processed much more slowly
by younger children than by older persons (Gummerman and Gray, 1972).

Sex

Petzold (1959) investigated the differences in music reading ability between sexes, and concluded that there exists no significant difference between ability of boys and girls to read music. More recent research, however, disclosed that differences in learning processes do exist between the sexes, and that these differences may be attributed, at least in part, to the revelations of brain research. Research indicated that not only do differences in learning processes exist between the halves of the brain, but these differences vary for females and males. This topic will be covered more fully in the section dealing with the lateralization of the brain hemispheres.

Cohen (1978) concluded that language is organized quite differently in the brains of males and females. The female brain is more sensitive to experimentally administered lights and sounds, while the male brain is primarily visual (Restak, 1979). Maccoby and Jacklin (1974) investigated the performance differences of the sexes but scarcely mentioned the brain as a source of these differences, presumably because most of the major findings regarding sex disparities in the brain have resulted since their book was published.

Two differences mentioned by Maccoby and Jacklin were
the focus of much recent brain research: the superior
verbal ability of females, and the superior spatial ability
of males. Simply stated, the difference between the sexes
regarding what happens in different sections of the brain
depends upon which particular mental skill is being
exercised (Goleman, 1978).

Expectancy, Familiarity, and Cues

Eye movement photography has shown that reading times
can be separated into fixations, interfixations, and
regressions. Further, fixations may be subdivided into
seeing time, stabilization time, and central processing
time (Samuels, 1970). Smith and Haviland (1972)
investigated the perceptual superiority of words versus
nonwords in visual processing and concluded that fewer
units were needed to process a word than a nonword, thus
processing time was faster. Riegel and Riegel (1968) also
investigated the effect of familiarity and expectancy upon
stimulus recognition and processing and concluded that
items which have often been experienced and are repeatedly
presented are recognized faster and processed more
efficiently than those which are experienced less often.
The effect of stimulus realism and its impact upon
processing efficiency was investigated by Travers (1969).
Travers found that the most efficient learning was achieved
when realistic materials, as compared to abstract (nonword)
materials, were used in teaching.
Guthrie and Lumsdaine (1961) conducted research using paired-associate groupings in an effort to better understand the effect of several cueing methods. Visibility of the response term, or cue strength, was varied tachistoscopically, while adjusting the level of illumination. The results obtained indicated that cueing played an important role in visual processing, and that tachistoscopic cueing produced significant results.

The ease with which both structured and non-structured stimuli are processed was investigated by Boswell (1975). Children in grades two and four, and adults were tested for their ability to process structured versus non-structured information. Results indicated that subjects in all three age groups processed structured stimuli more efficiently.

Masking

Visual masking refers to the tendency for stimuli appearing either before or after another stimulus to interfere with the perception of the principal stimulus (Kahnemann, 1968). Because of the physiological manner in which the visual mechanisms acquire and process visual information, the current visual image may not be the only image being processed by the brain at that time. The previous visual image, unless masked by some technique, may very well be iconically interfering with the processing of the current image. To prevent this interference in visual learning situations, the tachistoscopic presentation of a
mask is often employed. The mask may be a darkened screen, an especially bright screen, or a patterned mask. Whatever the style, however, its purpose is to erase the interfering image and clear the field for a new image.

Not only does the speed with which information is presented interact with the masking technique employed, but the age of the subjects again has an effect (Ghent, 1960). Because of the already established theory that younger children require longer processing time for visual images than adults, it was found that children in the youngest age ranges appear to have difficulty when masking occurs after the main image (target). This difficulty is due to the fact that the latency of the image is beneficial to those who require longer processing times (Miller, 1972). During the process of target recognition, the progressively fading image is constantly reviewed by the learner until sufficient information has been extracted for encoding, or processing, to take place. The insertion of a mask after the target, while desirable for some reasons, does have this particular undesirable effect upon the youngest learners (Goodglass, 1971). Adjustment of image interval (presentation speed) could be made to compensate for this important factor.

Neisser (1966) investigated the effect of post-target masking with regard to the effect of dark, patterned, and highly illuminated masks. Lower levels of performance generally resulted when targets were followed by patterned
fields, with no significant sensitivity to duration of the target stimulus. The comparison of dark versus illuminated masking fields was confounded by sensitivity to the duration of target exposure, and thus no conclusions could be reached in this regard (Miller, 1970).

Duration, Speed, and Span (array size)

The effects of image duration, intervals between stimuli, and the eye span (array size) all interact in various ways upon the intake and processing of visual information. The phenomenon of latent image scanning has already been mentioned, and this certainly interacts with the duration of the image as a variable in processing. The speed at which stimuli are presented, the size of the image which must be grasped, and the intervals between image presentations all interact with duration in the complex process of learning. Stimuli presented for too short a duration are not sufficiently processed by some. Stimuli presented at too great a speed or too short an interval are viewed as an information overload by some. Blake and Vingilis (1977) varied the size of the interval between the first and second array, and they found that accuracy was highest at intervals in the range of 250-1000 milliseconds (msec) for subjects aged five years, nine years, and adults. The findings of this particular study appear to discount the developmental theories of information encoding processes.
Haith and others (1970) investigated the effects of array size upon perception. They concluded that although the actual processing steps followed by adults and children are similar, the size of array which may be processed by children is limited, and that to exceed this array size results in an information overload. A study of 140 first grade students revealed an increase in word perception errors when the speed of presentation was increased (Olson, 1968).

Research was also conducted on the ability of older subjects to process visual information of differing array sizes. Recent findings from a study conducted by Baumann and Schneider (1979) indicated that the quantity of print forty-two college students acquired in 40-msec tachistoscopic flashes was:

3.7 letters for random letters
9.3 letters for unrelated words (about 2 words)
11.5 letters for words in context (2.4 words)

This study not only provided insight regarding practical array sizes and durations, but also implied the superiority of subjects' ability to process items in context.

Vogel's research (1980) disclosed essentially the same information regarding subjects' processing ability regarding speed and span. The negative effects of masking were also noted. Tharp and Redding (1976), however, pointed out that too long a response time can have just as negative an effect as one which is too short. They noted
that long response-stimulus intervals encouraged processing beyond that normally required for encoding, and interference could occur.

Many of these past studies have suffered from an inability to create experimental conditions which most closely resemble the normal reading situation, and the validity of their results must be questioned. In recent studies, however, computer techniques have been employed in an effort to measure the actual practical eye span of the learner. Some of these experiments have used eye-movement controlled display systems. The idea was to identify the actual area of the image from which the reader picks up visual information during a fixation of the eye (Rayner, 1975; McConkie and Rayner, 1975; Ikeda and Saida, 1978; Rayner and Bertera, 1979).

In the experiment of McConkie and Rayner (1975), a computer periodically sampled the reader's line of sight reading from a cathode ray tube (computer screen). Certain limitations, however, serve to make this recent experiment one in which absolute realistic conditions do not yet exist. They are:

- Text was presented on a cathode ray tube.
- Subjects' head movement was severely limited.
- A computer-generated alphabet was used.
- Display blinking was noticeable by subjects.

Certain of these conditions may have influenced their results (Buurman and others, 1981)
In a most recent study, a similar experiment was conducted, again with the shortcomings of the cathode ray tube, but with other limitations mentioned in the previous study either reduced or eliminated. Analysis of the results indicated a perceptual span of 25 to 31 characters, or 12 to 15 characters to the right and left of the center of the image field. This span equals four to five degrees of visual angle (Buurman and others, 1981).

Item Position

The position an item occupies within the visual field has been shown to have an influence upon its reception and processing by the learner. Items positioned in the left half of the visual field were thought to be perceived more quickly than those in the right half (Mishkin and Forgays, 1952). When horizontal arrays were displayed, the preference was for the items to the left of the point of fixation (Heron, 1957). A vertical preference existed as well. Items favored were those in the uppermost portion of the visual field (Ghent, 1961; Ghent, 1963; Ghent and Bernstein, 1961; Kerpelman and Pollack, 1964).

In more recent research, Mandes (1971) noted fewer errors in processing for items which were positioned on the left and upper portions of the visual field. Keenan's research (1972) did not completely substantiate this, for he found that accuracy of processing was the greatest at the left of rows of information and poorest at the middle.
To further confuse the situation, White (1971) concluded that errors were fewest near the point of fixation, and still other research indicated a superiority for targets or images displayed in the right half of the visual array (Miller, 1971).

Keenan (1970) attempted to clarify the situation by offering the explanation, based upon his experiments, that the perceptual position phenomenon is a temporary condition which is influenced or polarized in favor of one hemi-field or the other by the type of information most recently viewed. In his study, recall of English showed left primacy, recall of Hebrew showed right primacy, and recall of binary patterns showed neither. He held that sequence may serve to polarize hemi-field primacy.

**Brain Hemispheric Specialization and Interaction**

There already exists a plethora of research concerning the functioning of the brain and the specialization of the halves. Initial research supported by surgical and electroencephalographic procedures led to the conclusion that there are two separate memory encoding processes involved (Brooks, 1980). The left hemisphere is now known to be involved in speech and logical, analytical thinking, while the right hemisphere is concerned with spatial relations and artistic and holistic processes. Research using tachistoscopic presentation indicated that left hemisphere recognitions were significantly more frequent
than right for both eyes, but the extent of left hemispheric superiority was greater for the left eye (McKeever and Huling, 1970). Kershner (1977) also found that reading was a left-brained or left hemispheric function regarding decoding of written language.

Unfortunately, further research indicated that the entire situation is not as simple as was first imagined, but instead is quite complex. The complexity of the functioning of the reading-encoding-memory process as studied in the past did not discourage educators from the pursuit of ways to improve instruction, nor should these new complex findings discourage modern educators.

Part of this newly discovered complexity is related to both verbal and visual memory processing. Cioffi and Kandel (1979) discovered a right ear superiority for both males and females when processing linguistic material presented verbally. DeRenzi and Spinnler (1966) speculated that the method of encoding, verbal or visual, was an interrelated function of the nature of input plus the preferred mode of the individual.

DeRenzi (1968) noted that most learners will attempt, whenever possible, to convert meaningless patterns into verbalizable patterns. Brandwein and Ornstein (1977) found that material which is easily visualized by the viewer may be stored visually, even if presented verbally. Finally, Wittrock (1975) discovered that certain words with high image concepts tend to be visually processed even if
directions are indicated to process them verbally.

The brain halves appear to work both independently and together, since research indicated that certain functions which may be carried on in separate halves of the brain appear to be more efficiently executed when both halves are involved (Ornstein, 1977).

This brain research has definite implications for the educator and the design and nature of instruction, just as did the development and past use of the tachistoscope. Certain other discoveries must be well remembered at those times when instruction is planned as well as implemented. One of these revelations is that the human brain approaches its adult size by age two, but continues to grow in neural processes until approximately the onset of puberty. It has been shown that some brain processes present at birth will degenerate if environmental stimulations necessary for their development are not presented.

That part of the brain responding to novelty, the hippocampus, has been isolated and studied, and indications are that this section plays a vital part in the formation of memory. This implies that the traditional procedure of rote learning might be reconsidered, substituting important information in novel and challenging ways in order to stimulate the hippocampus.

It has also been shown that brain growth occurs in spurts, and at different times during the life cycle. Timing instruction so as to present novel and challenging
information during a spurt cycle is suggested, while the practice and reinforcement of skills already learned might be reserved for plateaus in brain growth. One of the growth cycles known to exist in junior high/middle school years is between the ages of ten and thirteen, making children in this age range ideal for the presentation of new and challenging learning material (Saks, 1979).

The Tachistoscope

The word "tachistoscope" comes from two Greek words meaning "quick view." These instruments were widely used during World War II to train military personnel to quickly recognize enemy aircraft. The modern-day employment of the instrument assumes that its use helps to improve the visual span of the learner, and thereby will increase the speed at which visuals may be recognized or processed (Berger, 1969). The importance of increasing the perceptual span should be obvious for its impact in reading improvement. Readers who read in short spurts tend to read word by word rather than in phrases or sentences.

Solan (1969) presented a large array of research evidence which indicated that the tachistoscope was the preferred instrument for past research. This instrument still merits consideration for future experiments, at least as far as studies on the improvement of reading skills are concerned. He sees the instrument as acting as a tonic to the brain by helping develop some of those vital visual
sensory areas previously mentioned which must be exercised.

Language-Reading as Related to Music-Reading

Based upon research, some of the processes involved in language-reading are also involved in music-reading (Monroe, 1967). Stern (1972) recognized this possibility, and produced training materials which are based upon this premise. These materials deal with musical instruction of a melodic nature at the elementary school level. Debban (1977) also supported this belief, and she developed a series of note cards (similar to word cards) to develop visual identity of notational patterns.

Just as in language-reading, music teachers have recently begun to emphasize the use of a multimedia approach to music-reading instruction, with the expectation that methods which were effective in language-reading will also be effective in music-reading (Vasil, 1968).

Many of the variables influencing language-reading have been found to influence music-reading as well. One of these, the effect of environment, was investigated by Yoder (1969) with the conclusion that the hypothesis of a relationship between the quality of the teaching situation and learner performance on music-reading achievement evaluations was supported at the .01 level of confidence for pitch, and at the .( level for rhythm.

The favorable effects of a multimedia approach for developing musical rhythmic skills were noted by Bamberger (1975) in a study which concluded that traditional
music-teaching methods (employing little additional media) tend to emphasize only a single strategy, while a multimedia approach stimulates a greater development of several capacities within the learner.

Another area of similarity is that of prompting. In music-reading research, visual prompting was found to be superior to verbal prompting or no prompting at all (Wood, 1972). Auditory prompting, on the other hand, was found to be of no greater benefit than would have been expected by chance (Miller, 1973).

Lawrence (1973) investigated the use of horizontal eyespan exercises for increasing reading efficiency. He also studied the relationship of the number of eye fixations and music-reading speed, and vertical eyespan exercises for increasing recognition skills. He further investigated reading-rate exercises for preventing regressive eye movement in order to develop constant music-reading rates. Results indicated that individual instruction was superior to ensemble or group instruction and that certain rhythmic skills were mastered better individually. The ability to maintain a steady tempo was not one of these skills, however. Lawrence's study was based on a total sample size of only twenty subjects, consequently, the generalizability of the findings appears limited.

Jones (1968) investigated the relationship between perceptual time span, intelligence, music background,
verbal-reading, and music-reading achievement. Transparencies were presented by means of a tachistoscopic device mounted on an overhead projector to a group of 206 students, whose ages ranged from elementary school to college. The relationship between the following four factors and music-reading achievement was as follows:

- perceptual time span - small
- intelligence - some
- music background - small
- verbal-reading - not significant

The size of the sample of this study appeared sufficiently large to permit a generalizability, provided other factors were sufficiently controlled.

Musical reading span and musical memory were the subjects of an investigation by Sloboda (1977). Results suggested a clear analogy between the cognition of music and language, in that the knowledge of abstract structure is of importance in the immediate visual processing of the text.

Judd and others (1980) found some differences in language and music-reading processes. Musical symbols are more visually distinct than language symbols, and may be interpreted by means other than auditory-verbal images. Some musical symbols are more readily distinguished by their relative location and size than are language symbols. An example of this would be the time signature, which initially appears in the upper left hand corner of a sheet.
of music, or the clef symbol which also appears there.

Inference of interior elements of a horizontal array leads to greater frequency of errors in music just as in language reading, due to structural, rather than visual processing factors (Sloboda, 1976).

Mewes (1969) attempted to determine the effect of another factor in music which was already established as a negative influence in language-reading, that of crossed dominance. In his study, experience was found to be a greater influence than crossed dominance, but at his own admission, the size of the sample and non-representative nature of the sample limit the usefulness of the findings.

The effect of expectancy in language-reading has already been discussed. A similar effect in music is said to occur, in that pitches are believed to be mastered easier when presented in a series of tonal patterns, rather than verbally by letter names alone. MacKnight (1975) conducted research in this area using ninety fourth-grade students as subjects. All experimental variables appear to have been reasonably controlled. The Watkins-Farnum Performance Scale, a measure of instrumental sight-reading in extremely wide use in the field of music education, was used as an evaluation tool.

Some of the apparent differences between language and music skills in reading were discovered in an experiment in which both musicians and nonmusicians took part. Simply stated, musicians used certain parts of the brain
differently than did nonmusicians during the processing of musical information (McElwain, 1979).

In learning music, the left brain is believed to be responsible for initial information processing and short term memory storage, and the right brain is believed to be responsible for longer memory storage. Traditional music instructional methods dealing with rote drills, etc. rely upon the left brain to process information, but fail to take account of the fact that this information, no matter how well learned initially, could be lost to long term storage if functions of the right brain are ignored (Regelski, 1977).

Based on the literature and research reviewed, several conclusions may be drawn. Information processing in language-reading is similar to information processing in music-reading. Evidence suggested that some of the differences which exist between the two disciplines may be due to the different ways in which the brain functions and reacts to different stimuli. Language-reading and music-reading are thought to be closely enough related so as to permit the use of a device, the tachistoscope, for music reading research since it has seen such widespread use in reading research.

A severe lack of research exists in the area of rhythmic sight-reading using the tachistoscopic technique among junior high music students. Doerksen's study (1972) concentrated upon individualized rhythmic instruction using
an electronic device with conventional teaching methods. That device did not control image exposure. The sample in this study consisted of fifteen students.

Hammer (1961) investigated the use of a tachistoscope device mounted on an overhead projector to teach melodic sight-singing. The sample consisted of fourth grade students. This study did not stress instruction in rhythmic sight-reading skills, but instead stressed melodic skills, an area usually reserved by music educators for instruction which follows rhythmic sight-reading.

Houston (1963) investigated the effectiveness of the reading accelerator upon harmonic and melodic keyboard sight-reading achievement. The reading accelerator which Houston used is a device designed to accelerate reading rate. Subjects for the experiment consisted of twenty-two organ students. Conclusions were that the device facilitated students' ability to learn within a time limit, but the findings may be generalized to a restricted population only.

Lawrence (1973) developed and tested a model for self-instruction in rhythmic sight-reading. Although the study involved groups of only ten students for the control and experimental groups, the findings of the experiment suggested that further research in this area may prove fruitful, if conducted with much larger sample sizes, and with tachistoscopic techniques.
These studies, while valuable for their contribution to the existing body of research, are limited either in scope or generalizibility. None have addressed the area of rhythmic sight-reading training using tachistoscopic techniques and a sufficiently large sample to generalize with any degree of confidence to a sizeable population.
CHAPTER 3

PROCEDURES OF THE STUDY

Subjects

Subjects were eighty-six junior high music students from Denham Springs Junior High School, Denham Springs, Louisiana. Permission was obtained from that institution to conduct the research.

The rationale for selection of subjects in the age group of ten to thirteen years was based on findings which indicated that subjects in this age group were undergoing a period of increased brain growth. The readiness and need of subjects in this age range for the presentation of material in a novel manner have been established by research (Saks, 1979).

Permission to use human subjects in an experiment was obtained from the Louisiana State University Committee on Humans and Animals as Research Subjects. Appendix A contains a copy of that approval.

Subjects were divided into four groups for this factorially designed study. Students were randomly assigned to each class earlier during the year by the administration of Denham Springs Junior High School.
Instruments

A slide projector equipped with a lens barrel tachistoscope was used to project 35mm slides during instruction. The use of slides to teach music is an established procedure. The selection of the tachistoscope was based upon findings which suggested that it was the preferred instrument for research of this nature.

The test instrument was the Watkins-Farnum Performance Scale, a widely accepted standardized test of musical performance. Both Forms A and B were used.

Procedures

Subjects in this study received instruction on rhythmic sight-reading by the experimenter in their normal music classroom for a period of approximately twenty minutes per session, two sessions per week, for a period of approximately six weeks. The same slides containing common musical rhythmic patterns were displayed for each group during instructional periods. Variables such as verbal instructions, length of instructional time, etc., were standardized for each of the four groups. Group instruction was employed in teaching, but subjects were tested individually. During testing, a standard procedure was employed for each subject. This procedure was identical to that procedure which is contained in the instructions to the test instrument (Watkins and Farnum, 1954, 1962).
Students in group one received instruction in which slides were displayed in the center of the screen for the full duration of a musical measure. Students in group two received instruction in which the image was displayed in the center of the screen, but the duration of the image was limited to one second by the tachistoscope. Students in group three received instruction in which the image was displayed in the upper left corner of the image field for the full duration of a musical measure. Students in group four received instruction in which the image was displayed in the upper left corner of the image field, but the duration of the image was limited to one second by the tachistoscope.

Design

The design of this study was a 2 X 2 factorial, with subjects assigned to four groups. The following chart illustrates more clearly the design:

<table>
<thead>
<tr>
<th></th>
<th>Normal Item Position</th>
<th>Varied Item Position</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental</strong> (controlled duration)</td>
<td>N=24</td>
<td>N=24</td>
</tr>
<tr>
<td><strong>Control</strong> (non-controlled duration)</td>
<td>N=16</td>
<td>N=22</td>
</tr>
</tbody>
</table>
Testing

The Watkins-Farnum Performance Scale was administered as both a pretest and a posttest, with Form A as the pretest and Form B as the posttest. The reliability coefficient between Form A and Form B for grades seven through twelve was .94. The validity of this test was found by using rank-order correlations. Correlations between scores on both forms of the test ranged from .68 to .87 for the various musical instruments (Watkins and Farnum, 1954, 1962). Testing was performed individually, in a private environment.

Data Presentation and Analysis

This study sought the answer to the following questions:

1. Is there a significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique and those taught by conventional means?

2. Is there a significant difference in rhythmic sight-reading performance between subjects taught using an upper-left-hand item position and those taught using a normal item position?

3. Is there a significant difference in rhythmic sight-reading performance between subjects taught using the
tachistoscopic technique with the normal item position and subjects taught using the tachistoscopic technique with an upper-left-hand item position?

4. Is there a significant difference in rhythmic sight-reading performance between subjects taught by conventional means with a normal item position and subjects taught by conventional means with an upper-left-hand item position?

5. Is there a significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with a normal item position and subjects taught by conventional means with a normal item position?

6. Is there a significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with an upper-left-hand item position and subjects taught by conventional means with an upper-left-hand item position?

7. Is there a significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with a normal item position and subjects taught using conventional means with an upper-left-hand item position?

8. Is there a significant difference in rhythmic sight-reading performance between subjects taught using the
tachistoscopic technique with an upper-left-hand item position and subjects taught by conventional means with a normal item position?

Hypotheses Testing

Statistical procedures employed in analysis of test data included one way Analysis of Variance (ANOVA) and Analysis of Covariance (ANCOVA), with the pretest as the covariate. The findings were used to test the following hypotheses:

Hypothesis One: There is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique and those taught by conventional means.

Subjects who subsequently received the tachistoscopic treatment (Exposure 2) scored slightly higher on the pretest than subjects who subsequently received the conventional treatment (Exposure 1), and considerably higher on the posttest. Adjusting for the covariate (pretest), however, resulted in mean scores which were less different. In the following tables, Position 1 refers to conventional image location, Position 2 refers to upper-left-hand image location, Exposure 1 refers to conventional, or full duration, and Exposure 2 refers to tachistoscopic, or controlled duration. The mean scores shown in Table 1.
TABLE 1

Watkins-Farnum Performance Scale Pretest, Posttest, and Adjusted Means Scores by Exposure

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Pretest Means</th>
<th>Posttest Means</th>
<th>Covariate Adjusted Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure 1</td>
<td>8.1042</td>
<td>17.3958</td>
<td>19.6943</td>
</tr>
<tr>
<td>Exposure 2</td>
<td>12.1903</td>
<td>26.0597</td>
<td>22.9749</td>
</tr>
</tbody>
</table>

Analysis of covariance was computed to determine the effect, if any, of the pretest scores on the outcome, and the F-value for the scores related to exposure was determined to be 3.13, which was not significant at the .05 level of confidence. The findings are shown in Table 2.

TABLE 2

Analysis of Posttest Scores (adjusted for covariate) on the Watkins-Farnum Performance Scale by Exposure

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>F Value</th>
<th>Prob. of Chance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure</td>
<td>209.4693</td>
<td>1</td>
<td>3.13</td>
<td>0.0806</td>
</tr>
<tr>
<td>Pretest</td>
<td>8145.4393</td>
<td>1</td>
<td>121.74</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

The analysis of covariance showed no statistically significant differences in test scores related to exposure. The null hypothesis, there is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique and those taught by conventional means, was accepted.
Hypothesis Two: There is no significant difference in rhythmic sight-reading performance between subjects taught using an upper-left-hand item position and those taught using a normal item position.

Subjects who subsequently received images located in the center of the image field (Position 1) scored slightly higher on the pretest than subjects who subsequently received images located in the upper-left-hand section of the image field (Position 2). On the posttest, the reverse occurred. Adjusting for the covariate (pretest), students who received images in Position 2 had higher mean scores. The findings are shown in Table 3.

<table>
<thead>
<tr>
<th>Position</th>
<th>Pretest Means</th>
<th>Posttest Means</th>
<th>Covariate Adjusted Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position 1</td>
<td>10.3438</td>
<td>21.1354</td>
<td>20.4834</td>
</tr>
<tr>
<td>Position 2</td>
<td>9.9508</td>
<td>22.3201</td>
<td>22.1858</td>
</tr>
</tbody>
</table>

ANOVA was also computed, and the F-value for scores related to position was determined to be 0.91, which was not statistically significant at the .05 level of confidence. The findings are shown in Table 4.
Analysis of Posttest Scores (adjusted for covariate)
on the Watkins-Farnum Performance Scale by Position

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>F Value</th>
<th>Prob. of Chance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>60.5612</td>
<td>1</td>
<td>0.91</td>
<td>0.3442</td>
</tr>
<tr>
<td>Pretest</td>
<td>8145.4393</td>
<td>1</td>
<td>121.74</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Analysis of covariance showed no statistically significant differences in test scores related to item position. The null hypothesis, there is no significant difference in rhythmic sight-reading performance between subjects taught using an upper-left-hand item position and those taught using a normal item position, was accepted.

Hypothesis Three: There is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with a normal item position and subject taught using the tachistoscopic technique with an upper-left-hand item position.

Subjects who subsequently received the tachistoscopic technique (Exposure 2) with a normal item position (Position 1) scored higher on the pretest than subjects who subsequently received Exposure 2 and an upper-left-hand item position (Position 2). On the posttest the reverse was true. Adjusting for the covariate, there was a greater difference in mean scores in favor of subjects receiving Exposure 2-Position 2 over subjects receiving Exposure 2-Position 1. The findings are shown in Table 5.
TABLE 5
Watkins-Farnum Performance Scale Pretest, Posttest, and Adjusted Means by Cell with Exposure 2 Held as Constant

<table>
<thead>
<tr>
<th></th>
<th>Position 1</th>
<th>Position 2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>13.0625</td>
<td>11.3182</td>
<td>24.3807</td>
</tr>
<tr>
<td>Posttest</td>
<td>25.4375</td>
<td>26.6818</td>
<td>52.1193</td>
</tr>
<tr>
<td>Adjusted</td>
<td>21.2038</td>
<td>24.7461</td>
<td>45.9499</td>
</tr>
</tbody>
</table>

With Exposure 2 held as a constant, and the item position varied, the small difference which was found in test scores was not found to be statistically significant. ANCOVA was computed, with an F-value (for scores related to position) of 0.91, which was not significant at the .05 level of confidence. The interaction of position and exposure was also found to be not significant (F=1.05). The findings are shown in Table 6.

TABLE 6
Analysis of Posttest Scores (adjusted for covariate) on the Watkins-Farnum Performance Scale with Exposure 2 Held as Constant

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>F Value</th>
<th>Prob. of Chance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>60.5612</td>
<td>1</td>
<td>0.91</td>
<td>0.3442</td>
</tr>
<tr>
<td>Pos * Expos</td>
<td>70.2186</td>
<td>1</td>
<td>1.05</td>
<td>0.3087</td>
</tr>
<tr>
<td>Pretest</td>
<td>8145.4393</td>
<td>1</td>
<td>121.74</td>
<td>0.0001</td>
</tr>
</tbody>
</table>
The analysis of covariance demonstrated that no statistically significant difference existed for subjects receiving the same exposure, but with differing item positions. The null hypothesis, there is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with a normal item position and subjects taught using the tachistoscopic technique with an upper-left-hand item position, was accepted.

Hypothesis Four: there is no significant difference in rhythmic sight-reading performance between subjects taught by conventional means with a normal item position and subjects taught by conventional means with an upper-left-hand item position.

Subjects who subsequently received full image duration or conventional means (Exposure 1) with normal item position (Position 1) scored slightly less on the pretest than subjects who subsequently received Exposure 1 and an upper-left-hand item position (Position 2). On the posttest, there was a similar, but slight difference in favor of subjects receiving Exposure 1-Position 2. Adjusting for the covariate, the difference was even less, but in favor of Exposure 1-Position 1. Those findings are displayed in Table 7.
TABLE 7
Watkins-Farnum Performance Scale Pretest, Posttest, and Adjusted Means by Cell with Exposure 1 Held as Constant

<table>
<thead>
<tr>
<th>Source</th>
<th>Position 1</th>
<th>Position 2</th>
<th>Row Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>7.6250</td>
<td>8.5833</td>
<td>16.2083</td>
</tr>
<tr>
<td>Posttest</td>
<td>16.8333</td>
<td>17.9583</td>
<td>37.7916</td>
</tr>
<tr>
<td>Adjusted</td>
<td>19.7630</td>
<td>19.6255</td>
<td>39.3885</td>
</tr>
</tbody>
</table>

Analysis of covariance was computed (for scores related to item position) with an F-value of 0.91, which was not significant at the .05 level of confidence. The interaction of position and exposure was also found to be not significant (F=1.05). The findings are shown in Table 8.

TABLE 8
Analysis of Posttest Scores (adjusted for covariate) on the Watkins-Farnum Performance Scale with Exposure 1 Held as Constant

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>F Value</th>
<th>Prob. of Chance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>60.5612</td>
<td>1</td>
<td>0.91</td>
<td>0.3443</td>
</tr>
<tr>
<td>Pos * Expos</td>
<td>70.2186</td>
<td>1</td>
<td>1.05</td>
<td>0.3087</td>
</tr>
<tr>
<td>Pretest</td>
<td>8145.4393</td>
<td>1</td>
<td>121.74</td>
<td>0.0001</td>
</tr>
</tbody>
</table>
The null hypothesis, there is no significant difference in rhythmic sight-reading performance between subjects taught by conventional means with a normal item position and subjects taught by conventional means with an upper-left-hand item position, was accepted.

Hypothesis Five: There is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with a normal item position and subjects taught by conventional means with a normal item position.

Subjects who subsequently received images in Position 1 (normal) with Exposure 1 (conventional) scored considerably less on the pretest than subjects who subsequently received images in Position 1 with Exposure 2 (tachistoscopic treatment). On the posttest, an even larger difference in mean scores between the two groups was found. Adjusting for the covariate, however, the difference diminished greatly, and the actual means are shown in Table 9.

**TABLE 9**

<table>
<thead>
<tr>
<th></th>
<th>Exposure 1</th>
<th>Exposure 2</th>
<th>Row Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>7.6250</td>
<td>13.0625</td>
<td>20.6875</td>
</tr>
<tr>
<td>Posttest</td>
<td>16.8333</td>
<td>25.4375</td>
<td>42.2708</td>
</tr>
<tr>
<td>Adjusted</td>
<td>19.7630</td>
<td>21.2038</td>
<td>40.9668</td>
</tr>
</tbody>
</table>
ANCOVA was computed for scores related to exposure, and the F-value was determined to be 3.13. This was not significant at the .05 level of confidence. Again, the interaction between exposure and position was not significant. These findings are shown in Table 10.

**TABLE 10**

Analysis of Posttest Scores (adjusted for covariate) on the Watkins-Farnum Performance Scale with Position 1 Held as Constant

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>F Value</th>
<th>Prob. of Chance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure</td>
<td>209.4693</td>
<td>1</td>
<td>3.13</td>
<td>0.0806</td>
</tr>
<tr>
<td>Pos * Expos</td>
<td>70.2186</td>
<td>1</td>
<td>1.05</td>
<td>0.3087</td>
</tr>
<tr>
<td>Pretest</td>
<td>8145.4393</td>
<td>1</td>
<td>121.74*</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

*Significant at the .05 level

The null hypothesis, there is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with a normal item position and subjects taught by conventional means with a normal item position, was accepted.

Hypothesis Six: There is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with an upper left-hand item position and subjects taught by conventional means with an upper-left-hand item position.
Subjects who subsequently received an upper-left-hand item position (Position 2) and the tachistoscopic technique (Exposure 2) scored slightly higher on the pretest than subjects who subsequently received Position 2 and conventional means (Exposure 1). The difference in scores for the same treatments was greater on the posttest. Adjusting for the covariate resulted in a smaller difference in mean scores between the two groups. These adjusted means are shown in Table 11.

**TABLE 11**

<table>
<thead>
<tr>
<th>Watkins-Farnum Performance Scale Pretest, Posttest, and Adjusted Means by Cell with Position 2 Held as Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure 1</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Pretest</td>
</tr>
<tr>
<td>Posttest</td>
</tr>
<tr>
<td>Adjusted</td>
</tr>
</tbody>
</table>

ANCOVA was computed for scores related to exposure, and the F-value was determined to be 3.13, which was not statistically significant at the .05 level of confidence. The interaction of position and exposure was also analyzed, and the results indicated no significant effect. These findings are shown in Table 12.
The null hypothesis, there is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with an upper-left-hand item position and subjects taught by conventional means with an upper-left-hand item position, was accepted.

Hypothesis Seven: there is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with a normal item position and subjects taught by conventional means with an upper-left-hand item position.

Subjects who subsequently received Exposure 2-Position 1 scored higher on the pretest than subjects who subsequently received Exposure 1-Position 2. These groups displayed an even greater difference in mean scores on the posttest. When the scores were adjusted for the covariate, the scores between the two groups diminished significantly. These findings are shown in Table 13.

### Table 12

Analysis of Posttest Scores (adjusted for covariate) on the Watkins-Farnum Performance Scale with Position 2 Held as Constant

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>F Value</th>
<th>Prob. of Chance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure</td>
<td>209.4693</td>
<td>1</td>
<td>3.13</td>
<td>0.0806</td>
</tr>
<tr>
<td>Pos * Expos</td>
<td>70.2186</td>
<td>1</td>
<td>1.05</td>
<td>0.3087</td>
</tr>
<tr>
<td>Pretest</td>
<td>8145.4393</td>
<td>1</td>
<td>121.74*</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

* Significant at the .05 level
TABLE 13

Watkins-Farnum Performance Scale Pretest, Posttest, and Adjusted Means Scores by Cell Comparing Interactions

<table>
<thead>
<tr>
<th></th>
<th>Pretest</th>
<th>Posttest</th>
<th>Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure 2-Position 1</td>
<td>13.0625</td>
<td>25.4375</td>
<td>21.2038</td>
</tr>
<tr>
<td>Exposure 1-Position 2</td>
<td>8.5833</td>
<td>17.9583</td>
<td>19.6255</td>
</tr>
</tbody>
</table>

ANOVA was computed for the pretest, and the F-Value was determined to be 2.15. This was not significant at the .05 level of confidence for 3 and 82 degrees of freedom. More detailed information is shown in Table 14.

TABLE 14

Analysis of Variance Values of Pretest Scores on the Watkins-Farnum Performance Scale

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>389.867</td>
<td>3</td>
<td>123.2890</td>
</tr>
<tr>
<td>Within Groups</td>
<td>4693.170</td>
<td>82</td>
<td>57.2338</td>
</tr>
<tr>
<td>Total</td>
<td>5063.037</td>
<td>85</td>
<td></td>
</tr>
</tbody>
</table>

F-Value = 2.15413

Computing ANOVA on posttest scores for those groups, an F-Value of 3.34 was determined to be significant at the .05 level of confidence for 3 and 82 degrees of freedom. Table 15 displays those results in greater detail.
TABLE 15

Analysis of Variance Values of Posttest Scores on the Watkins-Farnum Performance Scale

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>1657.860</td>
<td>3</td>
<td>552.6210</td>
</tr>
<tr>
<td>Within Groups</td>
<td>13565.000</td>
<td>82</td>
<td>165.4270</td>
</tr>
<tr>
<td>Total</td>
<td>15222.860</td>
<td>85</td>
<td></td>
</tr>
</tbody>
</table>

F-Value = 3.34058

Using ANCOVA to adjust for the covariate, however, the difference in means scores between the groups diminished significantly. An F-Value of 1.05 was computed for the interaction of position and exposure, and this value was found to be not statistically significant at the .05 level. Table 16 displays these results in greater detail.

TABLE 16

Analysis of Covariance Values of Watkins-Farnum Performance Scale Test Scores Using the Pretest as the Covariate

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>F Value</th>
<th>Prob.of Chance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>60.5612</td>
<td>1</td>
<td>0.91</td>
<td>0.3442</td>
</tr>
<tr>
<td>Exposure</td>
<td>209.4693</td>
<td>1</td>
<td>3.13</td>
<td>0.0806</td>
</tr>
<tr>
<td>Pos * Expos</td>
<td>70.2186</td>
<td>1</td>
<td>1.05</td>
<td>0.3087</td>
</tr>
<tr>
<td>Pretest</td>
<td>8145.4393</td>
<td>1</td>
<td>121.74*</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

* Significant at the .05 level

The null hypothesis, there is no significant difference in rhythmic sight-reading performance between
subjects taught using the tachistoscopic technique with a normal item position and subjects taught by conventional means with an upper-left-hand item position, was accepted.

Hypothesis Eight: there is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with an upper-left-hand item position and subjects taught by conventional means with a normal item position.

Subjects who subsequently received Exposure 2-Position 2 scored higher on the pretest than subjects who subsequently received Exposure 1-Position 1. As was earlier the case, the posttest scores revealed an even greater difference. Adjusting for the covariate, however, resulted in means scores between the groups in which the difference significantly diminished. These findings are displayed in Table 17.

TABLE 17
Watkins-Farnum Performance Scale Pretest, Posttest, and Adjusted Means Scores by Cell Comparing Some Interactions

<table>
<thead>
<tr>
<th></th>
<th>Pretest</th>
<th>Posttest</th>
<th>Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure 1-Position 1</td>
<td>7.6250</td>
<td>16.8333</td>
<td>19.7630</td>
</tr>
<tr>
<td>Exposure 2-Position 2</td>
<td>11.3182</td>
<td>26.6818</td>
<td>24.7461</td>
</tr>
</tbody>
</table>

ANOVA was computed on the pretest scores with an F-Value of 2.15, which was not statistically significant at the .05 level for 3 and 82 degrees of freedom. Table 18 displays those results.
TABLE 18

One-way Analysis of Variance Values of Pretest Scores on the Watkins-Farnum Performance Scale

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
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<td>57.2338</td>
</tr>
<tr>
<td>Total</td>
<td>5063.037</td>
<td>85</td>
<td></td>
</tr>
</tbody>
</table>

F-Value = 2.15413

ANOVA was also computed on the posttest scores with an F-Value of 3.34, which was found to be significant at the .05 level of confidence for 3 and 82 degrees of freedom. Table 19 displays those findings in greater detail.

TABLE 19

One-way Analysis of Variance Values of Posttest Scores on the Watkins-Farnum Performance Scale

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
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<tr>
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<td>82</td>
<td>165.4270</td>
</tr>
<tr>
<td>Total</td>
<td>15222.860</td>
<td>85</td>
<td></td>
</tr>
</tbody>
</table>

F-Value = 3.34058

ANCOVA was computed to adjust for the covariate, and to test for interaction between position and exposure as it
related to these two groups. An F-value of 1.05 was determined to be not significant at the .05 level of confidence, as shown in Table 20.

TABLE 20
Summary of ANCOVA Values of Watkins-Farnum Performance Scale Test Scores Using the Pretest as the Covariate

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>F Value</th>
<th>Prob. of Chance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>60.5612</td>
<td>1</td>
<td>0.91</td>
<td>0.3442</td>
</tr>
<tr>
<td>Exposure</td>
<td>209.4693</td>
<td>1</td>
<td>3.13</td>
<td>0.0806</td>
</tr>
<tr>
<td>Pos * Expos</td>
<td>70.2186</td>
<td>1</td>
<td>1.05</td>
<td>0.3087</td>
</tr>
<tr>
<td>Pretest</td>
<td>8145.4393</td>
<td>1</td>
<td>121.74*</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

* Significant at the .05 level

The null hypothesis, there is no significant difference in rhythmic sight-reading performance between subjects taught using the tachistoscopic technique with an upper-left-hand item position and subjects taught by conventional means with a normal item position, was accepted.

The use of analysis of covariance demonstrated the effect of the covariate (pretest in this case), in that an F-value of 121.74 was computed, and this was found to be significant at both the .05 and the .01 level of confidence. The probability of chance was determined to be 0.0001, as shown in Table 20.
In summary, ANOVA and ANCOVA were used to analyze the data and to test the hypotheses. No statistical differences were found to exist among any of the groups, thus all null hypotheses were accepted.
CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The statistical analysis of data showed no significant differences in any of the hypotheses tested. All of the null hypotheses were accepted, and the researcher concluded that, within the limitations of this study, there was no difference in the rhythmic sight-reading performance among subjects taught using conventional means and tachistoscopic means, whether the image was located in the normal (center) position of the image field or in the upper-left-hand position. In this study, the expected increase in rhythmic sight-reading performance among subjects taught using the tachistoscopic technique was demonstrated in the posttest scores, but when those scores were adjusted for the covariate, the difference diminished to such a degree that the difference was not statistically significant. The expected increase in rhythmic sight-reading performance among subjects taught using an upper-left-hand image location was not demonstrated, nor was it statistically significant. There was also no significant difference in rhythmic sight-reading performance among subjects when the
several possible interactions of exposure and position were
analyzed.

That is to say, there was no trend in rhythmic
sight-reading performance among any of the subjects when
exposed to the several possible combinations of exposure
and duration employed during this study. It may be
concluded that the instructional treatments were effective
in aiding the subjects to acquire equal amounts of
information relevant to rhythmic sight-reading performance,
subject to the limitations of this study.

Recommendations

Based upon the findings of this study, the following
recommendations are made:

1. The effects of image duration and item position
should be further evaluated with different age groups and
with subjects from other types of schools and environments.

2. The actual effects of manipulation of such
variables as image duration and location could be better
evaluated if a more specifically designed test instrument
were available.

3. A similar study should be conducted which takes
into account other possible factors such as mental age,
history of performance on standardized tests, sex, etc.

4. The amount of variation in the duration of the
image might be increased in a future similar study.

5. The image location could be varied to include
other locations within the image field in a similar study.
6. The effect of illumination, if any, could be studied in a future similar study.

7. The effect of other media variables on musical performance might be studied in future research projects. These variables might include image size, color, style of illustrations, etc.

8. Finally, the effect of auditory stimuli to this type of instructional treatment needs to be studied.
REFERENCES


Jones, Dan H. "An Experimental Study of Three Methods of Training Industrial Executives in Reading Improvement." Ph.D. dissertation, Michigan State University, 1956.


Palmatier, Robert A. "Machines in the Reading Program--What are their Roles?" Paper presented at the meeting of the International Reading Association, Atlantic City, New Jersey, April 19-23, 1971.


Whittaker, Jeweleane Wilma. "Department of Reading and Study Skills at Texas Southern University: A Longitudinal Study to Determine an Effective Method of Teaching Reading to College Students Whose Backgrounds are Partially or Wholly Disadvantaged." Paper presented at the National Reading Conference, Tampa, Florida, December, 1971.


APPENDICES
LOUISIANA STATE UNIVERSITY
Baton Rouge Campus

From: Committee on Humans and Animals as Research Subjects.

To: Vice Chancellor for Advanced Studies and Research
    David Boyd Hall

Re: Proposal of TERRY O. WRIGHT INSTRUCTIONAL SUPPORT AND DEVELOPMENT
    Principal Investigator

Entitled A Study of the Telescoposcope in the Teaching of
    Rhythmic Sight-Reading

This is to certify that a quorum of the Committee on Humans and Animals as
Research Subjects reviewed the above proposal. The Committee evaluated the pro-
cedures of the proposal with appropriate guidelines established for activities
supported by federal funds involving as subjects humans and/or animals.

Recommendation of Committee APPROVED

Comments:

A review of this proposal by the Committee will be accomplished at least on
an annual basis and at more frequent intervals depending on the element of risk.

Date FEB 24 1982
Chairman, Committee on Use of
Humans and Animals as Research
Subjects
APPENDIX B

*TO BE RETAINED BY THE INVESTIGATOR:

EXPERIMENT PERMISSION FORM

My signature on this form indicates that I give permission for my student, ..........................., to participate in the educational study concerning the teaching of rhythmic sight-reading conducted by Terry O. Wright.

I understand that all participants are volunteers, and that they may withdraw at any time; that I have or will be informed of the nature of the experiment; that the data I provide will be anonymous, and will not be revealed without permission; that performance in the experiment may be used for additional approved research projects; and finally, that I shall be given an opportunity to ask questions prior to the start of the experiment and after participation is complete.

..............................
Parent/guardian

.................
Date
APPENDIX C

The Watkins-Farnum
Performance Scale
Form A

Hal Leonard Music, Inc.
c 1954

omitted due to copyright restrictions
APPENDIX D

The Watkins-Farnum
Performance Scale
Form B
Hal Leonard Music, Inc.
c 1962

omitted due to copyright restrictions
VITA

Terry Olean Wright was born May 12, 1944, in Blytheville, Arkansas, the second of two children of Mr. and Mrs. Olean Wright, and an identical twin. He attended Blytheville Public Schools from elementary school through senior high school and was graduated in May, 1962.

He received a Bachelor of Science degree, with Honors, from Mississippi State University, in June, 1965, with a major in Music Education. In August, 1966, he was awarded a Master of Education degree from Mississippi State University, with a major in Music Education.

During 1966-1970 he undertook doctoral studies in the School of Music at Louisiana State University. From 1970 through 1977 he served on active duty in the United States Army Signal Corps. Upon release from active duty he taught at Denham Springs Junior High School, Denham Springs, Louisiana. He studied at Louisiana State University from June, 1979 until December, 1982 to complete a Ph.D. in Educational Media. During his doctoral study he served as Graduate Teaching Assistant for the College of Education.

He is married to the former Martha Claire West of Lauderdale, Mississippi.
EXAMINATION AND THESIS REPORT

Candidate: Terry Olean Wright

Major Field: Education

Title of Thesis: A Study of the Tachistoscope in Teaching Rhythmic Sight-Reading

Approved:

[Signatures]

Major Professor and Chairman
Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination:

November 4, 1982