reading plus

scientifically based system of
reading appraisal/development

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Reading Plus

A Scientifically Based System for Reading Development

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Stanford E. Taylor

I. Introduction/Overview

A. Overview of Reading Plus

The Taylor Associates' Reading Plus System meets all reasonable requirements as a scientifically based system for reading enhancement in terms of scope of instruction, theory and pedagogical support, demonstrated effectiveness of instruction, implementation (teacher orientation and delineation of costs), assessment, similar service populations, and replacability (national, district urban, suburban and rural use program expansion).

Further, the Reading Plus System is especially unique in that it provides for the development of a wide diversity of areas of reading improvement not matched presently by any other supplemental reading improvement system in the nation. To ensure more comprehensive reading instruction, Taylor Associates' Reading Plus System provides for improvement in these key areas:

Visual Efficiency (binocular coordination, directional attack, motility and fusion) – The ability to make visual excursions freely, with precision and ease, while simultaneously exhibiting good directional attack. These capabilities epitomize a visual performance that is truly appropriate for the reading process.

Word Recognition (visual discrimination, decoding, extensive sight vocabulary and word recognition automaticity) – The ability to "unlock" unfamiliar words and to instantly recognize previously encountered words, implying strong identification/recognition skills and retentive visual memory

Vocabulary Development/Contextual Analysis (vocabulary acquisition, contextual analysis and vocabulary utilization) – The ability to effectively employ existing vocabulary, analyze context, determine the meaning and function of less familiar or unknown words and respond to context with an awareness of the variant meaning of words.

Rate of Reading (primary, intermediate and secondary/adult levels) – The capability to read at rates in accord with grade level expectations as well as study and word requirements

Comprehension Skills (literal understanding, interpretation, appreciation, analysis and evaluation) – The ability to use a variety of skills separately and in combination to extract meaning in reading and listening situations

Study Skills (tactics, flexibility, understanding and application) – The ability to successfully cope with content; to recognize and comprehend varying formats; to apply a broad array of comprehension strategies in order to better understand content and to apply these strategies in other reading, listening and learning situations

Selective Reading (overview skimming, preview skimming and scanning) – The ability to apply the skills of preview skimming, scanning and overview skimming in a systematic and effective manner in order to satisfy specific or limited reading needs

Reading/Listening Incentives (motivation, attitude and habits) – The ability to respond to a variety of reading and listening content; to more fully appreciate and enjoy the experience of reading and listening

Reading Plus provides for development in all four forms of reading in which a student will engage:

1. Usual Reading – This is the habitual and more casual approach used in reading newspapers, magazines, novels and other kinds of materials which do not require a high degree of comprehension.

2. Analytical (critical) Reading – This type of reading is often described as careful, thorough, analytical reading. This kind of reading approach is usually used when studying or when the material is intellectually challenging and requires attention to organization and details, evaluation and reflection. Usually, a high degree of comprehension is an intrinsic goal. The apparent rate in this kind of reading seems slower than usual, but this is generally due to the interruptions and rereading.

3. Accelerated (study type) Reading – This approach is characterized by rapid rate and intense concentration. During accelerated reading, the reader deliberately forces himself to read far more rapidly than usual while attempting to maintain high comprehension. In most cases, this approach is used when time is limited. Usually a more accomplished

and efficient reader can attain a reading rate which is 5 to 100% faster than his/her usual rate.

4. Selective Reading – This approach is differs from the other three in that the reader does not read all of the content. Instead, the reader consciously selects and reads only portions of the content, skipping over a considerable amount. The apparent rapid rate is due to the omission of much of the material.

Additionally, Reading Plus provides for decoding competence and automaticity in word recognition for beginning readers as well as listening development to reinforce reading competence.

Reading Plus is especially unique in its fluency appraisal and development. The goal of Reading Plus fluency development is to develop a student's ability to read with sustained attention and concentration, ease and comfort, at adequate reading rates (for various grade levels) and with good understanding.

The Reading Plus System provides enhancement in the following reading comprehension skill/competency areas in many of its instructional approaches:

1. Literal Understanding
   - 1-1 Recalling Information and Details
   - 1-2 Following Sequence of Ideas or Events
   - 1-3 Identifying Speaker

2. Interpretation
   - 2-1 Main Idea
   - 2-2 Making Inferences
   - 2-3 Predicting Outcomes
   - 2-4 Drawing Conclusions
   - 2-5 Interpreting Figurative Language
   - 2-6 Visualizing
   - 2-7 Paraphrasing

3. Analysis
   - 3-1 Comparing and Contrasting
   - 3-2 Recognizing Cause and Effect
   - 3-3 Classifying
   - 3-4 Reasoning
   - 3-5 Identifying Analogies

4. Evaluation
   - 4-1 Detecting Author's Purpose
   - 4-2 Understanding Persuasion
   - 4-3 Recognizing Slant and Bias
   - 4-4 Distinguishing Between Fact and Opinion
   - 4-5 Judging Validity
   - 4-6 Determining Relative Importance

5. Appreciation
   - 5-1 Interpreting Character
   - 5-2 Recognizing Emotional Reactions
   - 5-3 Identifying Mood and Tone
   - 5-4 Identifying Setting

In the Reading Plus Programs that stress careful analytical reading, the following context analysis strategies are encountered:

- Same Meaning/Synonyms
- Opposite Meaning/Antonyms
- Association/Synthesis
- Categorization/Classification
- Time/Order
- Signal Words
- Phrases/Transitions
- Pronoun Referents
- Similarities/Differences
- Form/Function
- Conclusion/Summary
- Definition

B. Pedagogical Support

In this submission, each Reading Plus program section will contain the specific references to the theory and the pedagogical base to support its design and use. Many of the Reading Plus programs (especially in the area of fluency appraisal development) have had a long history of documentation, some extending as far back as the 1930s. Reading Plus, in general, has evolved over the years from conventional reading lab use. Thousands of such reading labs were established by EDL: Educational Development Laboratories and I/CT: Instructional Communications Technology. These two companies were founded by Stanford Taylor, President of Taylor Associates. Most of the programs were created

originally in filmstrips for use in projection devices and in cassette, kit and booklet form as far back as the early 1960s. From the 1960s through the 1980s, over 50 million students engaged in the reading instructional activities that are components of Reading Plus. Now, most all of the programs have been translated into more advanced software approaches by virtue of the trend today for increased use of computers to supply supplemental reading improvement instruction.

C. Evaluation – Demonstrated Effectiveness

In the numerous reports received over the last seven years that document student progress and growth, there are many references to improvement in standardized tests, and in some cases, state assessments. These research references cite program effectiveness as well as the pedagogical basis for the various Reading Plus programs. Following is a sample of such reports of average gains:

Grade	Test	Gains	Average Period Of Time
2 Average Population	Stanford 9	Gain of 5.7 compared with a decline of 4.7 for a control group	One School Year
3 Includes at-risk and Title 1 Students	ITBS	Average gain of 1.05 years	One School Year
4 Includes at-risk and Title 1 Students	ITBS	Average gain of 1.3 years	5.5 Months
Average Population	TAAS	TLI gain of 5.5, which was 48.6% better than the Texas state average improvement	One School Year
5 Remedial Students	ITBS	A gain of 1.61 years	Three Months
Average Population	TAAS	TLI gain of 1.4, which was 75% better than the average Texas state improvement	One School Year
6 At-risk and Bilingual Students	ITBS	Average of 1.32 years	Three Months
Average Population	Gates-MacGinitie	Average gain of 2.4 grades compared to the students' previous average yearly gain of .6 grades	Seven Months
7* At-risk and Remedial Students	ITBS	Average gain of 1.57 years	6.5 Months
8* At-risk and Remedial Students	ITBS	Average gain of 1.50 years	6.5 Months
9* At-risk and Remedial Students	ITBS	Average gain of 1.5 years	One School Year
Adults Includes college freshman who scored under the 12th grade level on the Nelson-Deny test	Nelson-Deny	Gain of 12.2%, or 1.5 levels on the Comprehension portion of the test	Three Months

ITBS=Iowa Test of Basic Skills
TAAS=Texas Assessment of Academic Skills
TLI=Texas Learning Index
*Includes data from a study done in Great Falls, Montana 1996-98 where students who were instructed with Reading Plus gained an average of 1.4 years compared with a control group who only gained 0.4 years.

Beyond the use of standardized tests, there are over 1,200 schools in the U.S. that also employ the Taylor Associates' Visagraph Eye-Movement Recording System, in conjunction with Reading Plus, to measure student gains in reading efficiency. Pre/post tests using the Visagraph are recommended by Taylor Associates. An overview of typical grade level gains in Visagraph eye-movement measures is presented below:

Grade	GLE Gain	Beginning Rate (WPM)	Rate Gained (WPM)	Beginning Number of Fixations	Fixation Reduction	Beginning Number of Regressions	Regression Reduction	Average Number of Sessions
2	1.2	106.5	+26.5	198	-32.0	41.5	-12.0	31.5
3	1.5	112.7	+27.3	192.8	-30.7	41.5	-11.8	25.7
4	2.4	135.0	+44.0	176.7	-39.7	37.1	-15.4	34.5
5	2.6	122.9	+50.6	194.6	-44.9	45.5	-19.3	42.5
6	1.8	111.7	+39.7	231.0	-56.7	53.7	-19.3	36.8
7	3.4	145.7	+66.5	195.5	-54.8	40.0	-17.5	45.0
8	3.2	123.4	+66.5	126.5	-54.8	22.8	-17.5	44.0
9	3.6	180.0	+61.9	136.0	-45.3	21.0	-14.1	37.3
College/ Adults	4.4	216.5	+147.8	107.2	-39.0	15.4	-9.9	23.5

In terms of experimental design evaluations, many of the schools using Reading Plus have not performed conventional experimental evaluations, but have rather gauged progress based on gains made in performance in state competency tests, standardized test changes or Visagraph improvements, which was their primary objective. There are, however, a number of research reports in which schools used experimental control populations that did demonstrate significant gains in reading improvement for experimental groups over control groups as a result of the use of the Reading Plus System.

D. Implementation

Terms of Use

The Reading Plus System software programs have been in use in over 3,000 schools across the U.S. for over eight years. This system has been in use for three years or more in some 1,800 public and private schools across the U.S. (in many as long as 6 and 7 years). Many of the programs were originally designed in DOS format and were then updated and enhanced as Windows and Macintosh formats were developed and released.

It should also be noted that the Reading Plus system is modular in nature, and as such, some schools may be using the system in total while others have selected certain programs to answer their specific goals and objectives with certain school populations.

Teacher Orientation Services

To ensure successful implementation of the Reading Plus system, three teacher orientation sessions are typically provided by a local Taylor Associates consultant/representative (usually one full day of initial orientation followed by two half days as follow-up sessions). In addition, a Reading Plus Instructor's Manual that describes installation, management, and recommendations for the use of each Reading Plus program and expected goals, is provided with every Reading Plus installation. See the appendicies for a copy of Taylor Associates' Standard Reading Plus Teacher Orientation Outline. (Appendix A)

Beyond this print material there are two Teacher Orientation CDs that provide a review of the goals of each program, guidance as to key issues with each program use, and a description of the specific goals and objectives of each program. These CDs can be used as ongoing reference and for review. A similar manual and CD is likewise available for use with the Visagraph Eye-Movement Recording System. The appendicies contain a sample of Taylor Associates' standard Visagraph Orientation folder and Visagraph Certification Appraisal. (Appendices B and C)

System Support

From a technical and program support standpoint, Taylor Associates' representatives provide both technical and pedagogical support, and Taylor Associates, through its toll free line, 800 READ PLUS, provides convenience of contact to ensure the successful use and continuation of each Reading Plus System and its programs.

Taylor Associates does also, through its research department, continue to gather progress reports from Reading Plus sites, and this information is continuously released through Taylor Associates' representatives.

Assessment

In terms of recommended assessment, most schools will choose to use either their usual standardized reading test or state competency exams to evaluate the effectiveness of Reading Plus. Beyond these more conventional measures, Taylor Associates also offers the Visagraph Eye-Movement Recording System which records and evaluates changes in reading efficiency. The combination of measurement of both reading effectiveness and reading efficiency is unique to the Reading Plus System.

Costs

Costs for implementing a Reading Plus System are clearly and specifically listed in each school's proposal. These costs will vary based on the Reading Plus System programs selected and the levels to be installed. Any costs for extended teacher orientation charges beyond those provided at the start of any program are also clearly outlined by Taylor Associates' representatives. Since there are no special teacher services required (usual school staff administrating Reading Plus) to supervise or direct the Reading Plus activities there are no unexpected or unusual teacher services required.

It should be noted that there are no consumable costs involved in the use of the Reading Plus software programs. There are only one-time costs for purchase. Finally, over the years as new versions were released in Windows and Macintosh formats, schools were generally supported with new updated versions at no cost.

Replicability

In each state where Taylor Associates is represented (presently 39 states) there has been, over the last seven (7) years, a steady increase in the use of the Reading Plus System. Today, there are over 3,000 schools throughout the U.S. using Reading Plus in urban, suburban, and rural settings. In the school year 2002-2007, it is expected that Reading Plus will be installed in over 500 new schools.

The types of students served to date range from those enrolled in Title 1 programs, Special Ed activities, At Risk services, General Student Improvement courses, Adult Basic Education, College Level Advancement programs, etc. And beyond these, there are many home study users. The most diverse population of students will be found in

urban areas. Some that are served include Chicago, New York City, Detroit, Wichita, and Atlanta. The Reading Plus System is also being used in such suburban areas as Irving, TX; Warren, MI; Metairie, LA; Aurora, LO; Greenwich, CT; and Tinley Park, IL, and rural areas such as Burgaw, NC; Dimitt, TX; Jeffersonville, GA; and Talihina, OK. There appears to be no real limit or constraint in terms of the use of the Reading Plus System in any type of setting with any type of student population.

Thus, the Reading Plus System is unique in its scope of learning activities, the range of students who can benefit from its use, the simplicity of its installation and maintenance, its low per student cost, and the growth and improvement changes that have been reported from its use.

II. Reading Plus Programs

In this section, each Reading Plus system program is described in terms of its purpose and scope, use and nature, history and pedagogical background, current research reports, and bibliography where relevant.

The Reading Plus system is composed of the following programs in these major categories:

Appraisal

- Visagraph Eye-Movement Recording System – to measure reading efficiency of the Fundamental Reading Process and adequacy of visual/functional skills.
- CPA: Computerized (Reading) Placement Appraisal – to measure a student's independent reading level, usual reading interest and vocabulary study level, and to place students in the most appropriate level in each Reading Plus program.

Fluency Development

- Guided Reading and PAVE: Perceptual Accuracy/Visual Efficiency Training – to develop sustained attention and concentration, ease and comfort, adequate reading rates (for various grade levels), and more thorough comprehension.

Contextual Analysis/Vocabulary Improvement

- CLOZE-PLUS and Reading Around Words – to develop careful analytical reading and study skills and to develop mastery of vocabulary use and meaning.

Accelerated Comprehension

- Comprehension Power– to develop the capacity for higher reading rates, more thorough comprehension, and study skill strategies.

Selective Reading

- Skim Scan – to develop the essential study and life skills of preview skimming, overview skimming, and scanning.

A. The Visagraph II Eye-Movement Recording System

The Visagraph and the Fundamental Reading Process

The Visagraph Eye-Movement Recording System was designed by Stanford E. Taylor and released in 1985. The Visagraph was the first eye-movement recording system to employ the Apple microcomputer as a means of recording and analyzing oculo-motor performance during reading. The Visagraph II, released during the 1990's, increased the ease and use of electronic sensing and recording with the flexibility, extensive memory and analytical capability of the P.C. computer. The Visagraph II eliminated the effects of head movement and removed the need for calibration and alignment of each subject prior to testing. The Visagraph II automatically calculates reading efficiency components and provides graphical representation of a subject's reading performance, or what Taylor terms the Fundamental Reading Process (FRP).

One develops their Fundamental Reading Process (FRP) early in life through a series of "trial and error" adjustments. This is a subliminal process that a reader does not control and which over time becomes habitual. A child's FRP is born out of his pre-reading, looking and observation habits. (52). Kindergartners and first graders typically move their eyes three times per second in most visual tasks, an oculo-motor activity conditioned by pre-school observation activities in general. They then carry their habit of frequently moving their eyes into reading. However, beginning readers cannot typically identify and recognize words in their usual eye-pause time of .33 seconds (3 movements per second) and so they resort to making multiple fixations to recognize words. Typically first graders will make an average of 2.2 fixations per word during silent reading as determined in the extensive norm study of oculo-motor behavior in reading by Taylor (51).

A major component of the FRP is visual/functional competence. An individual's visual/functional competence consists of one's visual acuity (ability to see clearly), binocular coordination and fusion (use of the two eyes in a coordinated manner that produces a single vision), ocular motility (the ease with which the eyes move) and accuracy in tracking. These visual competencies impact both the way words are perceived and the ease and comfort of reading.

The FRP also includes an individual's perceptual accuracy/efficiency. As one's eyes track along a line of print there is an awareness of a flow of words and ideas, which is created through a series of brief visual impressions, received each time the eyes pause during reading (fixation). The reader experiences what appears to be a continuous flow of words while in fact multiple fixations may be made for every word perceived.

A reader will also make a number of what are termed regressions or reverse eye-movements. While readers may be conscious of rereading they are seldom aware of such habitual and random regressive eye-movements, which are followed by a recover left-to-right eye-movement. These subliminal movements can consume one-third or more of a beginning reader's total reading time. Regressions can inhibit and confuse perception of what is read and waste time and energy in the process.

Thus one's oculo-motor activity as measured by the Visagraph Eye-Movement Recording System consists of an appraisal of the number of eye-pauses per word (fixations), the degree of habitual regression and the average length of eye-pause time. Too many regressions, too many fixations, and pauses that are too lengthy combine to make an inefficient reader.

The final component of the FRP is information processing. Words are received into short-term memory through a series of word impressions. These word impressions are either realized as properly sequenced expressions of language or they are resequenced (not consciously) if they are received out of order as a result of regressions and visual wandering. Individual words must be "chunked" into larger units of language to be realized mentally as phrases, complete sentences and larger messages. If understanding cannot be achieved then there will be a conscious need to reread.

There are limits to short-term memory that can affect retention and literal understanding. Short-term memory can hold a maximum of five to seven items at any one time according to Muller (34) and only for intervals of three to four seconds. These limitations on short-term memory make it vital that the reader be able to recognize words rapidly and accurately, in proper sequence and then quickly "chunk" words into larger syntactical units to minimize the number of items in short-term memory so retention can be maintained and good comprehension achieved.

A reader's FRP is a subliminal process and not necessarily subject to conscious control. There are a number of studies that demonstrate the involuntary quality of eye-movements. Carmichael and Dearborn (6) summarized the thought on this subject "…the normal reader cannot voluntarily control the number of his fixation pauses, regressive movements or the other regular actions of his eyes as he reads. It is possible by very specific training to change the frequency and character of such movements, but this is not accomplished merely by consciously trying to do so. It was not possible, that is, for any subject with whom we have worked to change his eye movements merely by resolving to him, 'I will now fixate less frequently than I have done in the past and make

fewer regressive movements while I carefully read for comprehension this printed page.' The normal subject, of course, has no direct knowledge of the number of fixation pauses or regressive movements that his eye makes as he reads."

Readers do not vary their eye-movements significantly when reading different types of text. Seibert (44) studied the effect of varying subject matter on reading performance. Taylor, Frackenpohl, and Pettee (50), Litterer (28), Morse (33), and Ballantine (2) studied the effect of reading performance on varying difficulty of content. All of these studies substantiated the relatively habitual nature of oculo-motor performance in reading and showed that the average reader alters his/her eye-movement pattern only slightly unless the material is far too difficult.

Furthermore, studies have indicated that when a reader is being recorded he will perform in a manner similar to when he is not being recorded. L.C. Gilbert and D.W. Gilbert (17) tested 47 fifth grade pupils to determine whether their reading differed when reading on an eye-movement camera. They found that both comprehension and reading time were not significantly different on the camera as away from it. Tinker (53) came to the same conclusion from correlations of .87 and .90 between rate and comprehension before and away from the camera. Hoffman, Wellman, and Carmichael (21), in comparing electrical and photographic recording of eye-movements, also confirmed that persons read similarly on and away from an eye movement camera. Thus from these studies it can be determined that a reader's FRP is relatively constant and can be accurately measured with an eye-movement recording device.

The Recording Process and Its Measurements

The Visagraph II Eye-Movement Recording System measures the efficiency and elements of a reader's Fundamental Reading Process (FRP) (visual/functional proficiency, perceptual development, and information processing competence). The Visagraph II uses a system of infrared sensors in goggles to track eye-movements as a student reads a passage in the Visagraph testing booklet. The Visagraph samples eye-movement positions 60 times per second and automatically computes various reading performance measures. A comprehension check follows to determine if the subject read with reasonable comprehension that suggests a usual reading performance. This process of eye-movement recording can be regarded as a "time and motion" study of the reading process.

The reading appraisal can be used in different ways. It can be used as an initial assessment tool to determine a reader's efficiency. Once such a determination is made, a program of fluency development such as Taylor Associates' PAVE: Perceptual Accuracy/Visual Efficiency and Guided

Reading, can be assigned. The Visagraph can also be used during the course of a fluency development program to determine whether or not additional measures need to be taken to ensure significant changes in an individual's Fundamental Reading Process. At the conclusion of a reading fluency program the Visagraph can be used to measure overall changes in a subject's FRP.

Before one's FRP is evaluated by the Visagraph, the tester must determine what the appropriate reading level should be for the passage to be read. It is very important that the subject be able to read "an easy to read" passage so the performance will be indicative of their most fluent manner of reading. The level of test can be determined by Taylor Associates' CPA, a computerized reading appraisal program, which determines a subject's Independent Reading Level. Furthermore informal reading inventories or an oral pre-test can be administered to determine an appropriate reading level. Beginning readers who cannot read a Level 1 Visagraph selection (Reading Level 1.8) fluently can take the Visual Skills Test or the Numbers Test. The Visual Skills Test is a non-reading test that is designed to determine the efficiency and effectiveness of a subject's binocular control, tracking accuracy and motility. The Numbers Test is designed to evaluate the same skills as the Visual Skills Test. Both tests are non-reading in nature.

The student then slips on the infrared goggles, which are adjusted to his/her inter-pupillary distance. The examiner then tells the subject to begin reading when he/she hears a beep. Subject should be told to close their eyes when they have finished reading. As the subject reads the passage two traces will appear on the computer screen. These traces will scroll down the screen as the subject reads the passage, indicating eye-movement.

When the subject has completed reading the passage he/she will be asked a series of 10 questions to determine comprehension level. If the subject fails to reach 70% comprehension the tester may ask the subject to read the same selection in the Visagraph Test Selection booklet aloud. If it is read with few errors, the appraiser can either accept the Visagraph test as valid and reflective of the subjects reading performance or administer a second test selection on the same or lower level. If the second test selection yields inefficient comprehension skills, it can be assumed that the subject reads with habitually low comprehension.

Following the administration of the comprehension questions, a reading profile will appear on the screen. It provides calculations of all reading performance characteristics as well as a graph, which plots these performances against Taylor's National Norms (51). The information provided in the profile includes the following:

Fixations – Fixations are eye-stops that refer to the intervals in reading a line of print during which the eye is held relatively stationary for a short period of time and during which perception takes place. After each fixation the eye moves to a new fixation position; this interfixation movement is called a saccade. The eye moves along a line of print in a series of fixations or eye stops and then sweeps back in a larger saccadic movement to begin the next line of print. The number of fixations per line of print is related to an individual's reading level and age. The average adult reader will make 8-10 fixations per line, while the superior reader will make approximately 5. An elementary school reader will make 13-22 fixations per line. The Visagraph profile records the number of fixations per 100 words.

The more fixations a reader makes, the more time is spent in reading and the more energy is consumed in the reading process and the greater the degree of reading inefficiency. An excessive number of fixations can be caused by:

1. Difficulty with visual acuity or binocular coordination, i.e. the inability to see well enough or to coordinate the eyes properly.

2. Conditioning of early reading experiences – Conditioning that becomes habitual during the early stages in reading often caused by an introduction of a large number of new words each week without automaticity of word recognition training. This will cause considerable visual wandering. An emphasis on oral reading can also cause visual wandering. An overstress on phonics may cause an interruption of the fluent reading process if words are habitually and unnecessarily analyzed, as well as difficulties with comprehension.

3. Perceptual factors – Include the manner in which an individual perceives words, recognizes words accurately and retains them in short term memory. If a reader over scrutinizes visual material, an excessive number of fixations will result.

4. Comprehension Difficulties – If a reader comprehends poorly then there will be a tendency for the reader to employ an excessive number of fixations as he/she pauses or ponders, attempting to achieve understanding

The fixations that a reader makes are depicted by vertical lines shown in the Visagraph Model Graph. Horizontal lines that connect the vertical traces are saccades. A staircase movement in the graph represents the two eyes moving from left to right along a line of print. At the end of each

line, a return sweep occurs where the eyes swing back and the subject starts to read a new line of print.

Regressions – A regression or a reverse fixation follows a right-to-left saccade or interfixation movement. The Visagraph measures the number of regressions per 100 words. The number of regressions are plotted in the same model graph as fixations and appear as small right to left movements.

Excessive regressions are caused by many of the same problems as excessive fixations. Regressions though, can be classified as either habitual, those caused by reading diffi-culties of the moment, or neurologically activated.

1. Habitual regressions are the result of inadequate formation of directional attack. As the individual learned to read he/she employed a certain amount of corrective movement in each line of print. This corrective movement became so ingrained that it occurs at similar points in every line of print. Many individuals incorporate a number of regressions into their reading performance because of a lack of confidence and an ingrained need to double check words and context. This general insecurity in terms of remembering what they have read is sufficiently great to cause them to regress and even reread habitually.

Most regressions are of the habitual variety. Previously mentioned studies by Carmichael and Dearborn (6), Seibert (44), and Taylor, Frackenpohl, and Pettee (50) have indicated that the number of regressions a reader makes is as consistent as the number of his /her total fixations. Readers are seldom conscious of a regressive eye-movement, though total time spent in regressions may occupy from 1/5 to 1/3 of the readers total reading time. Regressions in an efficient reader should not exceed 10-15% of their total reading time.

2. Those that are caused by reading difficulties of the moment or sporadic fixations result principally from the content. Perceptual errors, inadequate interpretive or organizational ability, and/or lack of experience create the need to "check perception" of words. These regressions may, after a new fixation is made, be delayed in time.

3. Neurologically activated or cluster fixations are two or more regressions in succession at different points in their reading ability for no apparent reason. Pavlidis (36) associates this occurrence with a condition of dyslexia. He cites as additional symptoms, excessively large saccades in conjunction with regressions. This type of occurrence, however, needs further study.

Regressions should be distinguished from the conscious act of rereading lines of print. Regressions occur as small reverse direction interfixations, while rereads are more conscious acts in which previously read sections of lines or sentences, paragraphs or pages are reread because of a lack of comprehension or attention. Rereading is only productive in study type reading activities such as reading text material, content analysis, literary appreciation, etc.

Average Span of Recognition – The average span of recognition refers to the amount of words or word parts perceived during a fixation. Span is computed by dividing the number of words read by the number of fixations required to read 100 words. This average is computed realizing that there is some variation in the span of recognition from fixation to fixation.

The term span of recognition may have caused more misconceptions than any other aspect of reading. Many references have been made about the ability of children to see in phrases (three or more words) during reading and the ability of adults to "take in at a glance" four or five words, or even sentences. This misconception can be traced in part to early tachistoscopic theories and techniques that proposed a person could be trained to "see" four or five word phrases at 1/10 second or faster. One must realize though that seeing accomplished during tachistoscopic exposures differs greatly from that which takes place during continuous reading. Attention is considerably higher during tachistoscopic exposures than it is during continuous reading. Furthermore the "seeing" that is accomplished during a tachistoscopic exposure is not followed by other percep-tions that have the effect of reducing the span of recognition in continuous reading as substantiated by Gilbert (16).

A pilot study conducted by Taylor and Frackenpohl (49) with an eye-movement camera, showed that the span of a person involved in tachistoscopic exercises was considerably higher than his/her span while reading material of the same difficulty level. A study conducted by Gray (18) at the University of Chicago concluded that average silent reading span was only 1.6 words. A study conducted by McConkie (29) of college students who were recorded in reading situations in which letters in words were altered at various letter positions to the left and to the right to determine the extent of sensitivity of a readers span revealed that that the reader was sensitive to only four letters to the left and six to eight letters to the right of the fixation point. This is equivalent in total to less than two words, even with advanced readers.

Average Duration of Fixation – Duration of fixation refers to the length of time a reader's eyes pause during a fixation. It is computed by dividing

the time in seconds that it takes a reader to read the selection by the total number of fixations employed in reading the selection. The Visagraph II presents the actual duration of each fixation in the Model Graph with Values.

The duration of fixation tends to shorten as the reader matures, reflecting a decrease in his/her reaction time and an increase in the rapidity with which he/she associates and comprehends. This shortening of duration changes little though after the fourth grade (51) probably due to the fact that the reader's organizational, perceptual, and visual/functional maturation reflects itself principally in a reduction of fixations and regressions and an increase in span of recognition.

Rate with Comprehension – Rate with comprehension refers to the time it takes a reader to read a given selection with adequate comprehension. The Visagraph determines a reader's WPM (words per minute) reading rate by analyzing the time required to read 100 words.

Rate with comprehension should not be confused with a person's "skimming" rate or reading rate for reflective or analytical reading; the Visagraph rate reflects a person's "usual" rate at which narrative-information material is read. Many people assume that reading rate is variable and can be altered to suit different situations, when actually most people vary their reading rate slightly on material that could be classified as easy to fairly difficult. They do not accelerate their reading rate for what can be deemed "easy" material and may read more slowly for what is deemed reflective or analytical reading material. Most people read at a "comfortable" rate which requires a minimum amount of energy.

Some people may use "skimming" techniques to go though material faster. Such techniques don't necessarily involve reading material faster but rather involve a person altering his interpretive emphasis toward "looking," locating, and then reading. In a study by Grayum (19) of skimming the author noted, "Techniques involved in skimming included various degrees, marked changes in rate, pausing, regressing, looking back, and looking ahead." In those sections where a person read most thoroughly, they seemed to employ a usual manner of reading.

Many claim that astronomical reading rates of 1,000 to 6,000 words per minute can be reached, but as Gilbert (14) points out "People who are credited with such feats are actually engaging a highly proficient type of scanning or skimming. Unquestionably, masterful skimming is an extremely valuable skill, but it is not to be confused with reading."

The reading rate as measure by the Visagraph is based on the following conditions:

- The level of test material read is such that it permits a reasonable degree of fluency to be demonstrated.

- The test selections are structured so that they are reasonably complete in themselves with their facts and ideas presented in a sequential manner.

The subject will be told to read as quickly as possible but to read for an understanding of the material. According to national norms established by Stanford Taylor (51), beginning reader's read at rates of an average of 115-138 wpm. Average adults were found to read at rate of 175 to 300 wpm, with a typical average being 225 wpm. Superior readers read at an average of 500 wpm, while the best readers, after completing a reading course, will rarely see reading rates of above 650 wpm. In general there appears to be an upper reading limit of 800 wpm even for the most proficient reader.

Grade Level Efficiency – The Visagraph II will automatically calculate a reader's relative reading efficiency and equivalent grade level efficiency performance. The "relative efficiency" is a calculation that provides an objective numerical identification of the grade level equivalent of the subject's reading performance. It is based on the following considerations: that fixations, regressions, and rate (also reflecting duration of fixation) are the most important factors in judging levels of reading efficiency.

Directional Attack Difficulty – The term directional attack refers to the tendency of the reader to perceive and organize content in a left-to-right manner. A reader's directional attack correlates directly to the manner in which information is fed into short-term memory. A poor directional attack suggests that information is being processed, at times, in short-term memory in a non-sequential and non-syntactical manner.

Directional attack difficulty is determined by dividing the number of regressions by the number of fixations. Directional attack difficulty should desirably be 15% or less. If it is greater than 25% the reader is employing a poor directional attack.

Rate Adjusted for Rereading – The rate adjusted for rereading is a calculation that eliminates the effect of rereading. Instances in which a regressive movement is greater than 30% of the line value and any extra lines that are read by a student are deleted by extrapolation in the calculation of reading rate to eliminate the factor of rereading.

Comprehension – Comprehension is simply the percentage of comprehension questions answered correctly after the reader completed

the Visagraph test selection. A 70% or higher comprehension level suggests a reader read in a typical manner, while a level of below 70% may suggest the need to retest with a different or lower level selection.

Cross-Correlation – Cross-correlation is a statistical analysis of the equivalence of horizontal movements of the subject's eyes through the countable lines of print. If a subject's cross-correlation falls below .90 there may be a cause for concern as to the adequacy of binocular coordination.

Countable Lines/Lines Found – In most cases the number of lines found by the computer equals the number of countable lines. If however, the number of lines found exceeds the countable lines then the subject has reread lines. If the number of lines is less than the countable lines then the computer could not discern a sufficient return sweep activity.

Saccades in Return Sweeps – Ideally the number of return sweeps should equal the number of lines found. Excess return sweep saccades indicate compensating movements made during the process of executing a return sweep. If a student has poor binocular coordination or tracking skills then the number of saccades and return sweeps can be 2 to 3 times greater than the number of lines found.

Anomalies – Anomalies in excess of 4 in any of the 3 categories reported can signal visual/functional difficulty. The categories are the following:

The first number indicates instances in which one eye moved in a forward direction and the other eye did not move substantially enough to be recognized as a forward fixation.

The second indicates the instances in which one eye moved in a reverse direction and the other eye did not move sufficiently to be detected as a new regressive fixation. The third indicates the instances in which two eyes appear to move in opposite directions.

As a result of the profile that is developed of the reader's Fundamental Reading Process, a fluency development program may be administered to enhance the subject's FRP. The Visagraph provides an analysis and recommendations feature that could suggest the need for a fluency development program. Results of the Visagraph analysis of the FRP are compared against a set of national norms. These norms are grade level averages of fixations, regressions, average span of recognition, average duration of fixation, rate, and relative efficiency. Indications of the need for a fluency development program are excessive numbers of fixations and accompanying reduced span of recognition; an excessive number of fixations; a pro-longed duration of fixation; poor directional attack;

inadequate return sweeps; habitual reading; inadequate rate with comprehension; and poor comprehension.

If there is a reason to suspect that a student's visual functioning is not adequate (low cross-correlation, excessive return sweeps, anomalies etc), a Functional Readiness Inventory may be administered to a student. A series of questions are asked which reflect a student's awareness of visual/functional problems. Questions include: Do you like to read? Do you get headaches when reading? Do your eyes get itchy? Do your eyes see muddied, blurred, or double print?

Current Research Reports and Usage

Currently the Visagraph is being used by over 1,400 vision specialists and schools to assess the reading process of people of all ages. Taylor Associates has a number of research sites in which the Visagraph was used. The following is a list of Taylor Associates Research Briefs which incorporated Visagraph analysis. Summaries can be found on the Taylor Associates' website: http://ta-comm.com/background/research.html:

Brief 12
Bailey Intermediate School
The Visagraph was used to evaluate the pre-and post instruction performance of 15 intermediate school students. Results showed a significant reduction in fixations and regressions and a marked increase in rate with comprehension and Grade Level Equivalent

Brief 14
Irving High School
The Visagraph was used to evaluate 14 Irving High School students after a program of 11-20 half-hour treatments using Taylor Associates Guided Reading Program. Results showed decreases in both fixations and regressions and increases of 24 and 6 respectively. Rate with comprehension improved by 38 WPM, while GLE improved by 2.8 levels.

Brief 15
East Falls Middle School
At-risk students were given a program of Taylor Associates Reading Plus; they were evaluated before and after instruction with the Visagraph. Students who received 60 sessions of Guided Reading experienced a decrease of 43 fixations and 15 regressions, their GLE improved by 4.5 levels and reading rates improved by 109 WPM.

Brief 16
Kennedy Middle School
Eighty-eight students including special-ed students were evaluated with the Visagraph. Results showed that after an average of 31 sessions with Reading Plus fixations were reduced by 32 and regressions fell by 5. Overall reading rate improved by 34 WPM.

Brief 17
Woodville Elementary School
Nineteen students were given pre and post Visagraph analysis. Students received less than the 40 recommended Guided Reading sessions. A post-instruction Visagraph analysis revealed that the students' fixations were reduced by 28, regressions dropped by 8, while GLE improved by 1.26 levels, and reading rate improved by 23 WPM.

Brief 18
Jackson Elementary
Twenty students completed an average of only 25.8 sessions of Reading Plus a month. Post-instruction Visagraph analysis revealed that fixations fell by 51.95, regressions were reduced by 19, GLE improved by .735 and rate with comprehension improved by 20 WPM.

Brief 20
Grovetown Elementary
Over 100 3rd, 4th, and 5th graders participated in a study involving the effectiveness of Taylor Associates' Guided Reading. The students were given a Visagraph analysis prior to instruction and after instruction was completed. Post-instruction Visagraph analysis revealed that fixations and regressions dropped by 34 and 12 respectively, while rate with comprehension improved by 45 WPM and the average GLE increased by 2.6 levels.

Brief 22
Morgan County Elementary School
A study of over 183 students in grades 3 and 4. Students were given a pre-instruction analysis with the Visagraph. Students then received 30-50 sessions with Taylor Associates' Guided Reading program over a two-year period. Post-instruction Visagraph analysis revealed GLE increased an average of 2.7 (Grade 3) and 4.1 (Grade 4) over a period of 2 years.

Brief 23
City Park Elementary
Eighteen 3rd-6th graders received 40 sessions of instruction with Taylor Associates' Guided Reading program. Prior to instruction students were tested with the Visagraph to measure the efficiency of their FRP. After instruction was completed students received a Visagraph analysis again to

measures changes in their FRP. Post-instruction analysis revealed that fixations decreased by 27, regressions fell by 14, GLE improved by 1.6 grades, and rate with comprehension increased by 26 WPM.

Brief 24
Twiggs County, GA
Twenty-six students participated in a program which evaluated Taylor Associates' Guided Reading program. Students were given both pre and post instruction Visagraph analysis. Overall students received less than 16 hours of instruction with Reading Plus. Despite the limited time using Reading Plus, students displayed strong gains in the post-instruction Visagraph analysis. Fixations and regressions dropped by 35 and 15 respectively, reading rate improved by 16 WPM and GLE increased by 0.9 grades.

Brief 27
Statesboro High School
A study of eleven 9th graders were given a Visagraph analysis both prior to instruction and after instruction has been completed. Students completed 45-50 sessions of Taylor Associates Guided Reading. Post-instruction Visagraph analysis showed that fixations and regressions fell by 51 and 16 respectively. Rate with comprehension improved by 80 WPM and GLE increased by an impressive 6.0 grade levels.

Brief 29
Frank Stone Middle School
This study comprised 43 students who were in both regular classes and special education classes. Students completed 40-50 sessions of Taylor Associates Guided Reading. Students were evaluated with the Visagraph prior to and after instruction. Post-instruction Visagraph analysis revealed that both the regular and special education students made significant gains in the measurable elements of the FRP. Average GLE for the regular class improved 2.9 levels, while the special education's average GLE increased by 1.9 levels.

Brief 30
Cook Elementary
One hundred eighty four 3rd grade students were involved in a study to investigate the effectiveness of Taylor Associates Reading Plus program. All students were given a pre-and post instruction Visagraph analysis. Results showed that GLE jumped 2.0 grade levels, while the rate with comprehension improved by 42 WPM

Brief 33
MacArthur High School
Fifty-four ninth grade Title-I students completed only 20 sessions of Taylor Associates Guided Reading program. Students were given both a pre-and post-instruction Visagraph analysis. Post-instruction Visagraph analysis showed that fixations decreased by 23, regressions fell by 7, GLE improved by 3.0 grade levels and reading rate increased by 49 WPM.

Brief 34
Marysville Elementary
Twenty-two 2nd and 3rd graders completed an average of only 20-25 sessions of Guided Reading and thirty-two 4th graders completed. Both groups were administered the Visagraph both prior to and after instruction. Post-Visagraph analysis of both groups revealed that the second and third grade class's average GLE increased by 1.1 years, while the 4th graders saw their GLE improve by 2.2 levels.

Brief 38
Beebe Elementary
A controlled study of 11 2nd graders and 14 third graders. Those in the experimental group received 40 sessions of instruction with Taylor Associates Guided Reading Program, in addition to instruction with other Taylor programs. Those in the control group received normal classroom reading instruction. Students in both groups were given a Visagraph analysis prior to and after instruction. Post instruction analysis shows that both the 3rd grade and 4th grade students who received instruction showed more pronounced improvements in the measurable elements of the FRP.

Brief 39
Northeastern Junior College
A study involving two remedial reading classes with a total number of 74 students involved. Both classes were two months in duration and both utilized Taylor Associates Guided Reading and PAVE programs. Students in both classes were given a pre-and-post instruction Visagraph analysis. Post-Instruction Visagraph analysis revealed significant gain in areas of the FRP, including GLE improvements of 3.5 and 4.2 grade levels respectively.

Brief 40
Indiana Wesleyan University
A study involving 97 incoming freshman in a critical reading class who did not achieve a 12th grade level on their Nelson Denny Comprehension or Vocabulary test. Before the class instruction began, all students were given a Visagraph analysis. After completing approximately 36 sessions of Reading Plus students were given a post-instruction Visagraph analysis which showed that fixations and regressions dropped by 31.9 and 8.2

respectively. GLE improved by 4.5 levels, while rate jumped by 100.8 WPM.

Brief 42
National Learning Systems
Forty-four students were involved in a READ TO SUCCEED course, which is an intensive 30-hour reading course using Taylor Associates Reading Plus Programs. All students were given a pre-instruction Visagraph screening. After completion of the program, students were evaluated again with the Visagraph. Results showed that fixations dropped by 39, regressions fell by 12, rate improved by 100 WPM and GLE improved 4.8 grade levels.

Brief 43
Rusk Elementary
Classes of 10 fourth graders and 15 fifth graders used Taylor Associates Reading Plus programs throughout the school year. Students in both grades received a pre and post instruction Visagraph screening. Post-instruction Visagraph analysis revealed that students in 4th grade class saw an average improvement in GLE of 2.9 levels while the fifth grade classes average GLE increased by 2.7 levels.

Third Party Research

In addition to the studies that have been reported by Taylor Associates at various schools across the country, a number of third-party research has been conducted with the Visagraph.

Solan, et.al (45) – In his study entitled Role of Visual Attention in Cognitive Control of Oculomotor Readiness in Students with Reading Disabilities, published in 2001 used a Visagraph to measure the effect of eye therapy and comprehension therapy on students, and whether the order of instruction is important. Two groups of Reading Disabled students were first measured with the Visagraph. One group of students received eye movement therapy for 12 weeks followed by comprehension therapy for 12 weeks. The other group received the same instruction but in inverse order. Students were evaluated with the Visagraph after each training period. The result of the study revealed that the order of therapy, comprehension first or eye-movements first, was not significant. Eye-movement therapy improved eye-movements and resulted in significant gains in reading comprehension, while comprehension therapy also produced improvements in eye-movement efficiency and in reading comprehension.

Schlange Studies – Dr. Darrell Schlange of the Illinois College of Optometry has conducted numerous studies involving the Visagraph.

1. Evaluation of the Reading Plus 2000 and Visagraph System as a Remedial Program for Academically "At Risk" Sixth and Eighth Grade Students: A Pilot Study (43) A study conducted at Shields Elementary school in Chicago. At-risk students were assigned to receive instruction with Taylor Associates Reading Plus System. All students received a pre-and post instruction analysis with the Visagraph. Results showed that students in the 6th and 8th grade who received training with Reading Plus gained 0.9 and 2.3 levels in their GLE as measured by the Visagraph, respectively. In addition the 6th and 8th graders saw gains of 1 year and 1 year 4 months, respectively. Schlange concluded that the Reading Plus and Visagraph systems are an effective remedial program for "at risk" elementary students, improving both reading and visual/functional skills.

2. Evaluation of Eye Movement Test Protocol for Assessing Saccades and Pursuits in Athletes (41) The purpose of this study was to evaluate a new test protocol for assessing distance eye movements in a population of athletes. The Visagraph II was used to objectively measure eye movements in a sample of 310 athletes. The study concluded that the new test protocol has a clinical value in evaluating distance eye-movement skill in athletes.

3. Evaluation of an Eye-Movement Recording Technique in a Population of Autistic Children (40) The purpose of this study was to evaluate TA's Visagraph II for recording fixations and saccades in autistic children. The study suggested that that this technique has clinical value for evaluating eye-movement skills in a population of autistic children. Guidelines are provided to assist the clinician in interpreting the results and integrating them with data from other members of the interdisciplinary team.

4. Visual and Ocular Characteristics of Adults with Attention Deficit Disorder: A Case Study (39) A case report describing the history, evaluation, and treatment of a 49 year old successful professional male with symptoms of being visually overwhelmed during visual tasks. An eye-movement exam with the Visagraph indicated problems with duration of fixation, span of recognition, and reaction time. The study concluded that the common treatment for adults with ADD is counseling to provide behavior and environmental modifications to reduce visual distractions.

5. Effects of Text Typography on Eye Movements During Reading (42) The purpose of the study was to determine whether changing the

typographical characteristics of the reading text will influence the efficiency of reading eye movements. The Visagraph II system was used to objectively measure eye movements. The study concluded that a significant improvement was observed in the eye movements when subjects read the wide format paragraphs (fixations, reading rate, span of recognition, standard deviation of fixation duration and binocular cross-correlation). The clinical implications of these results are discussed.

Colby, Laukkanen, and Yolton (7) a study entitled Use of the Taylor Visagraph II system to evaluate eye movements made during reading published in 1998 evaluated the reliability and validity of the data it produced. The study employed fifty first-year optometry students as subjects. Each subject read five standard Taylor Level 10 (College) paragraphs during each of two sessions while the Visagraph assessed eye movements. The results of the study showed that the Visagraph operated correctly for 498 of 500 trials, operator error caused two malfunctions. The study concluded that the Visagraph performed properly over a large number of trials and produced data that seemed reliable indicators of reading skills

Steinman and Steinman (46) Kansas Optometric Association Vision Therapy Study, A study that investigated the effects of vision therapy on reading performance using Qualitative Reading Inventory II (QR-II) test and Visagraph II Eye-Movement Recording System as measures with control group. Vision therapy produced an improvement of one grade level in their GLE as measured by the Visagraph. The control group saw no significant improvement.

Studies in Progress

In addition to the studies mentioned above there are other studies currently in progress that involve the Visagraph Eye Movement Recording System:

1. 2002-2004 National Assessment of the Fundamental Reading Process, Taylor Associates, A study of over 150 schools and institution to update the norms established by Stanford E. Taylor (51) in 1961

2. Dr. Darrell Schlange of Illinois College of Optometry, is currently working on two projects:

    a. A study to compare the Number Profile Visagraph evaluation compares with the patient's Reading Profile and Visual Efficiency Evaluation. The study will take patients ages 6 to 35 and they will be selected following a comprehensive eye exam and/or visual efficiency evaluation. The study expects to find

that the Numbers Profile will have results that correlate with both the Reading Profile and Binocular Vision tests.

b. A study that will compare the effectiveness of treating saccadic disorders with Guided Reading versus a program of conventional oculomotor therapy. It is expected that a program of Guided Reading will successfully treat oculomotor disorders equal to or better than conventional oculomotor therapy. The Visagraph will be used a an efficiency measure in this experiment.

3. Dr. Cynthia Raehl of the Texas Tech School of Pharmacy is conducting an experiment which evaluates the effect of Taylor Associates Reading Plus programs on older adults. The subjects who are participating in the study will first be evaluated with the Visagraph to assess their visual and functional proficiency, perceptual development, and information processing competence. After their initial evaluation subjects will be trained with Reading Plus for 3 months. A control group will also be employed. The author's hypothesis is that improvement in the Fundamental Reading Process will result in improved health literacy and medication management in the elderly

Testimonials

The following testimonials briefly describe the use of the Visagraph II Eye-Movement Recording System in school/institutional settings, training programs, and research projects:

Arapaho Public School
Arapaho, OK
Contact: H. Kirk/B. Haggard

"We use the Visagraph system to appraise reading performance efficiency with all students. The Visagraph is a wonderful diagnostic tool."

Athol Desmond Study Centers/Read Educational Resources/Vision
South Africa
Contact: Stan Lederman

"Read Educational Resources through its affiliated diagnostic and developmental Learning/Reading Laboratories-Athol Desmond Study Centers- has been involved in the field of Reading, Communication, and Study Skills training since 1954 in southern Africa. "We run our own Assessment and Reading Laboratories for various clients. In October 1996 we purchased the Visagraph and have been using it fairly extensively over the past year within our assessment representative database."

Brownsboro ISD
Brownsboro, TX
Contact: Anthony Bruner

> "We use the Visagraph system to appraise reading performance efficiency with Special Education, high-risk, and Title I students. We have been involved with Taylor Associates for years and have found their approaches to be most effective."

Cantwell, Dennis R., O.D.
Annandale, VA

> "I am a developmental optometrist and have found the Visagraph useful in demonstrating to parents their child's tracking problems. In addition, the Visagraph is an excellent tool for demonstrating the improvement gained from the patient's visual therapy program."

Chattooga County Schools
Menlo, GA
Contact: Phyllis Sparks

> "We use the Visagraph system to appraise reading performance efficiency with Special Education, high risk and Title I students."

Cockerell, Gilan L., O.D., F.A.A.O.
Emporia, KS

> "We have had the Visagraph for several months. It has proved a very valuable tool in measuring and documenting difficulties with ocular motor mobility and mobility skills. It has become a very important part of our regimen in evaluating problems associated with reading and learning difficulties."

Englander, Mark, Ph.d.

> "I use the Visagraph to assess reading problems in developmentally disabled offenders in correctional institutional rehabilitation and for pre/post reading measurement in conjunction with TA's Guided Reading program."

Freedom Elementary
Freedon, NH
Contact: Alice Morrison

> "We use the Visagraph system to appraise reading performance efficiency with High-Risk students. We have found it useful and the students enjoy their involvement."

Fred G. Acosta Job Corps Center
Tucson, AZ
Contact: Leila Duncan

> "I use the Visagraph for essentially two functions; (1) to evaluate a student's relative reading visual efficiency and (2) to provide motivation by showing them some reasons for their reading difficulties and also to show them the progress they have made by using Reading Plus. I generally administer the Visagraph test when a student is scheduled into lab, which they have for 45 minutes each day and then again in about eight weeks or whenever they have reached their reading goals on the T.A.B.E. (Test of Adult Basic Education). Thank you again for the upgrade of a program which I endorse wholeheartedly!"

Gainesville Job Corps Center
Gainesville, FL
Contact: Elia T. Massanet

> "Students in our Job Corps range from age 16-24. The population is diverse and includes High-Risk and Special Education students as well as drop-outs and students whose parents cannot provide the education the need. We use the Visagraph system to appraise the reading performance efficiency of students in all of these groups."

Goldstein, David, Ph.d.
Lawnside, NJ

> "I use the Visagraph as part of a diagnostic battery for children referred by child study teams in New Jersey."

Greensboro Primary School
Greensboro, SC
Contact: Andrea Roper

> "I use the Visagraph system to appraise reading performance efficiency with High-Risk and Title I students."

Grisham, David, O.D., M.S., Clinical Professor
Berkeley, CA

> "In a collaborative project between Pasadero, Inc., a software development company, the School of Optometry, University of California at Berkeley, investigators Ian Bailey, Larry Boyd, and David Grisham are utilizing the Visagraph II to monitor the eye movements of dyslexic and normal readers to evaluate computer screen modifications thought to improve reading purposes and are investigating the effect a moving window has in helping dyslexics keep their eyes on the line. This is an attempt to prevent tracking problems during reading. The Visagraph data analysis is a convenient

way to evaluate changes in reading strategies with this screen modification and others that are being developed."

Heinke, Marilyn Brenne, O.D.
Seymour, WI

"The Visagraph is used in my practice to evaluate oculo-motor efficiency in relation to visual functional factors and reading capability."

Holley-Navarre Middle School
Navarre, FL
Contact: Michael Thorpe

"We use the Visagraph to appraise the reading performance of 300 sixth grade students. Every child is tested, and then we focus in on any students that demonstrate any reading deficiency. In a three year period we will have tested every student in our school."

Illinois College of Optometry
Chicago, IL
Contact: Dr. Darrell Schlange
"I am using the Visagraph in several research studies including:

1. Eye movements in autistic children
2. Evaluation of eye movements in adults and children with ADD and ADHD
3. New protocols for evaluating eye movements in the athletic population
4. Correlating the Visagraph eye recordings with T.O.V.A. (Test of Variables of Attention)
5. Effect of colored filters on reading eye movements
6. Evaluation of Ocularmotor Functions in Individuals with SSS
7. Correlating VIsagraph eye movement recordings with the Applied Science Lab
8. The Visagraph for evaluating pre and post-therapy changes in oculomotor disorders
9. Correlating the VIsagraph with Standardized saccadic tests (DEM, NSUCO, etc.)

10. The optimal reading text and column dimensions for efficient eye-movements"

Institut fur Leseforschung
Pforzen, Germany
Contact: Franz Biglmaier

"I have now prepared some German texts for the Visagraph, but not enough for testing purposes. I am still working on it. My intention is to test young children starting to learn to read in first and higher grades with the Visagraph and correlate the results with my data I collected during the last 14 years with German, English, Hungarian, and Rumanian speaking children. Last year at the World Congress of IRA in Prague, and this year at the 10th European Reading Congress in Brussels, I have reported on the outcomes of this research."

Jean Lafitte Elementary
Lafitte, CA
Contact: Tammy Cantrelle

"We use the Visagraph to appraise reading performances with High-Risk students. In combination with the Guided Reading program, it is a powerful motivational tool."

Little Axe Public School
Norman, OK
Contact: Rebecca L. Ernest

"We use the Visagraph system to appraise reading performance efficiency with students in Title I as an evaluation tool and to specifically help children gain efficiency and comprehension in preparation for 4th grade."

Wayne Maltz, O.D.
Houston, TX

"In my practice, the Visagraph II is used to evaluate oculo-motor efficiency and tracking in relation to visual functional factors and reading capability."

Marfa Elementary School
Marfa, TX
Contact: David Clark

"We use the Visagraph system to appraise reading performance efficiency with all students. We have found it to be highly valuable in analyzing reading deficiencies within our elementary population."

Marsh Middle School
Fort Worth, TX
Contact: Ferrell Yeokum, Principal

> "Marsh Middle School is in the second year of using the Visagraph system for diagnostic purposes. We use it almost exclusively to test our incoming sixth grade students. From this assessment we can see clearly what the students eyes are accomplishing while reading a passage. The Visagraph is especially helpful with our special education students and limited English proficiency students. We are grateful that we have this valuable technology at our disposal."

Mesa Verde Middle School
San Diego, CA
Contact: Gayle Andrus/Jackie Felton

> "Currently all of our students are given Taylor Associates' CPA in conjunction with a math assessment test. Any students scoring significantly below grade level expectations are tested with the Visagraph to further evaluate the nature of their reading deficiencies."

Michigan College of Optometry
Big Rapids, MI
Contact: J. James Saladin, O.D., Ph.d

> "In addition to the usual optometric services of ocular health and refractive care, the Michigan College of Optometry offers clinics which address binocular-oculomotor, pediatric, and developmental problems. While we do not treat reading problems per se, we diagnose and treat the conditions which together form much of the base of the reading process. We serve as a referral center for Western Michigan and receive referrals from schools, physicians, optometrists, and other professionals who encounter people with vision and reading problems. The Visagraph is used in the diagnostic phase to detect and quantify reading problems and to monitor the effect of treatment efforts in the management phase."

Monroe Primary School
Monroe, GA
Contact: Melissa Turner

> "We use the Visagraph system to appraise reading performance efficiency with second grade students."

Mora Eye Clinic
Laredo, TX
Contact: David Saul Mora, O.D., Ph.d.

> "We are currently using the Visagraph as an initial evaluation of eye movement control, reading speed, reading efficiency and fixation

control (for low vision patients). After therapy is completed, we recheck these skills to measure their progress."

New England College of Optometry
Boston, MA
Contact: Jack Richman, O.D., F.A.A.O., F.C.O.V.D.

"I am using the Visagraph clinically and for clinical research in: Evaluation of eye movements in reading and non-reading tasks related to learning disorders. Evaluation of eye movements in reading and non-reading tasks related to binocular vision disorders, amblyopia, and strabismus. Assessment of eye move-ment behaviors in covularmotor disorders, e.g. nystagmus, traumatic acquired brain injury, and recognition with police agencies."

Niceville High School
Niceville, FL
Contact: Dan Durrett, Technology Coordinator

"The center for the Study of Literacy and the College of Optometry at Northeastern State University, Oklahoma, is investigating the effects of oculo-motor dysfunctions on academic achievement. This study will involve 300 or mire primary grade children and is being planned as a longitudinal evaluation that will explore the incidence and prevalence of visual/functional handicaps through a wide variety of visual recording and measurement of the oculo-motor activity during reading and visual/functional performances using the Taylor Associates' Visagraph II. This study will compare visual profiles with academic performance as measured by behavioral surveys of the teacher and parent as well as IOWA Achievement Scores. Research: W.C. maples, M.S., O.D., et al."

Oaks Mission School
Oaks, OK
Contact: Robbie Thompson

"We use the Visagraph system prior to beginning the Guided Reading Program and as a post-test measure of reading performance efficiency with Title I and High-Risk students."

Orangeview Junior High School
Anaheim, CA
Contact: Louetta Lacher

"We use the Visagraph system to appraise reading performance efficiency with Title I students and have found it an invaluable tool in combination with TA's Guided Reading Program."

Pacific University College of Optometry
Forest Grove, OR
Contact: Hannu Laukkanen, O.D. Med

> "Bob Yolton and I have corroborated on several student research projects using the Visagraph II. Past projects have looked at test-retest reliability, eye movement performance using spectral (colored) overlays, non-linguistic "word" targets, and the correlation of Visagraph II measured eye movements with other visual and psychometric measures."

Pearson, Alan, O.D.
Nome, AK

> "I have been using the Visagraph for graduate research in the psychological issues of reading; especially the relationship of visual performance in reading, decoding, and comprehension."

Pocola Public Schools
Pocola, OK
Contact: Frank Makinson

> "We us the Visagraph with low reading level students and plan to use it with all of the students in our system."

Reddick Collier High School
Reddick, FL
Contact: Susan Thelen

> "We use the Visagraph system to appraise reading performance efficiency with Title I students."

Riverside Indian School
Anadarko, OK
Contact: Regina Whitewolf

> "We use the Visagraph system to appraise reading efficiency using teacher referrals to the school-work integrated Career Center"

St. Phillip's College
San Antonio, TX
Contact: Janet A. Flores

> "Each semester I use the Visagraph as a pre/post-test in assessing the reading rate, comprehension, and oculo-motor behavior of all my students in the reading department. The students are fascinated by the Visagraph especially in the recording of their eye movement during a reading assessment. Being able to see a graphic of their eye movement actually motivates the student to actively participate in the Reading Program."

School for the Deaf and Blind
Great Falls, MT
Contact: Bill Davis, Principal

> "We are using the Visagraph system with deaf and hard-of-hearing students as a screening device to determine if these students are having any tracking problems as they read. When problems are observed, the student(s) are placed in the appropriate remedial program."

Southern College of Optometry
Memphis, TN
Contact: Scott Steinman, O.D. Ph.d, F.A.A.O

> "I am using the Visagraph as a tool to teach eye movement theory and clinical application to second-year optometry students. I am writing educational software for both the Macintosh and Windows computers for the data using the Visagraph device."

Sul Ross State University
Alpine, TX
Contacts: Sherry Peters/ Melissa Jone, Carol Woodward

> "We use the Visagraph system to appraise reading performance efficiency with College developmental reading students."

SUNY Optometric Center of New York
New York, NY
Contact: Dr. Harold Solan

> "We us the Visagraph for both clinical and research purposes. In the Visual Rehabilitation Clinic, it is uswed to monitor eye-movements during reading. The Learning Disabilities Unit finds the Visagraph valuable in appraising progress. Additionally, the Visagraph is currently being used as a research instrument in a study to measure eye-movement efficiency in normal and reading disabled elementary school children as we vary luminance and wave-length of light. We also use the Visagraph as a measurement tool in conjunction with research involving Taylor Associates' PAVE and Guided Reading."

TekNowledge Ed. Media
Federal Way, WA
Contact: Curtis R. Baxtrom, O.D., F.C.O.V.D.

> "We use the Visagraph to help evaluate children with learning difficulties as well as with head trauma patients. It is a very important part of our evaluation and management of patients."

University of California School of Optometry
Berkeley, CA
Contact: Clifton Schor

> "My uses are primarily for teaching purposes with optometry students. I use the Visagraph to demonstrate various forms of nystagmus including optokinetic and vestibilar. I also demonstrate version and vergence eye movements and reading eye movements. Once the students finish my course on neurology and ocular motility, they use the Visagraph in our clinic to analyze reading eye movements of patients."

Valleyview Junior High School
Amarillo, TX
Contact: Phyllis A. Callahan

> "From a population of eighth grade students who had failed TAAS Reading Skills and objectives, the Visagraph was employed to monitor their progress in reading improvement. There was a significant statistical difference in fall and spring testing results. The Visagraph is a remarkable instrument and I have used the testing procedure on willing parents who visit my classroom."

Vision Learning Center
Houston, TX
Contact: Ann W. Voss, O.D.

> "I have used the Visagraph for two years now and love it. It is a wonderful tool for assessing eye movement function while reading. It is objective, specific, and repeatable. It is also invaluable in demonstrating to students and their parents how their eyes work while reading. I feel that it reflects the integration of eye movement patterns and cognitive processing. The more fluid the eye movement, the better the comprehension of the material. In my office the Visagraph is used in every reading individual at the beginning of vision therapy. It then is a very useful gauge to assess progress in ocular-motor therapy."

Walesby Vision Center
Tampa, FL
Contact: John R. Walesby, O.D. F.C.O.V.D. and J. Robert Walesby

> "We treat patients of all ages with binocular vision dysfunctions. We pre and post-test their eye movements with the Visagraph to illustrate before and after therapy results to patients."

Wedemeyer, Elissa R. O.D.

> "As a developmental optometrist, I work with children who lave LD, including visual/perceptual delays and dyslexia. I can observe a child's poor eye movement, but without hard copy, have nothing to

show to parents and educators or show progress. I use the Visagraph as baseline data at the beginning of therapy and the end. I find the reading stimulator version helpful to show parents what eyes are doing."

William J. Berry Elementary
Heidelberg, MS
Contact: Beverly Bultard

"We use the Visagraph system to appraise reading performance efficiency with Title I students."

Ysleta ISD
El Paso, TX
Contact: Robert Nase

"As an educational diagnostician, I use your program to assist with the teaching of reading."

The following schools/institutions also have agreed to serve as references and contacts for the Visagraph II Eye-Movement Recording System:

Contact	**School**	**City/State**
Linda Anderson	Cotton Plant Elementary	Cotton Plant, Arkansas
Sheryl Coolie	Jonesboro Adult Education Center	Jonesboro, Arkansas
George Smith	Brawley High School	Brawley, California
Jackie Felton	Poway USD-Mesa Verde Middle School	San Diego, California
Susan Higgins	Sam Brannan Middle School	Sacramento, California
Dina Dimler	Serra Catholic School	Santa Margarita, California
Tom Pease	Taft High School	Woodland Hills, California
Cindy Graham	Pueblo Community College	Pueblo, Colorado
Carol Anderson	Oak Park Middle School	Leesburg, Florida
Jan Folsom	Cook County Elementary School	Adel, Georgia
Phyllis Allen	Altamont Grade School	Altamont, Illinois
Jan Grossi	Willow School	Homewood, Illinois
Donna Dintelman	Belle Valley School	Belleville, Illinois
Gail Yocum	Healy Elementary	Chicago, Illinois
Elizabeth Wagner	Bogan High School	Chicago, Illinois
Darlene Argeropolis	Glensdie Middle School	Glendale, Illinois

Sandi Dorst	ECHO Visually/Physically Impaired Program	South Holland, Illinois
Chuck Krzan	Streator High School	Streator, Illinois
Ruth DeGroff	Indiana Wesleyan University	Marion, Illinois
Rhonda Heim	Arkansas City U.S.D.	Arkansas City, Kansas
Ann Arbuckle/ Lynn Gerber	Winfield High School	Winfield, Kansas
Barbara Larson	Garden City Community College	Garden City, Kansas
Roxanne Tilley	Maryville Junior High	Marysville, Kansas
Dave Sherrer	Metro Meridian	Wichita, Kansas
Bruce Asnpaugh	West Elementary	Valley Center, Kansas
Priscella Reese	Helen Cox Middle School	Harvey, Louisiana
Penny Lemonds	St. Ville Elementary	Harvey, Louisiana
Gerald Tkach	Flint/Genessee Job Corps	Flint, Michigan
Lisa Runyan	House Municipal School	House, New Mexico
Derrick Brown	Gadsden High School	Anthony, New Mexico
Janet Ward	West Pender Middle School	Burgaw, North Carolina
Winston Kerley	L.B. Yancey Elementary	Henderson, North Carolina
Adolphus Coplin	Robert B. Glenn High School	Kernersville, North Carolina
Harold Smith	Parkland High School	Winston-Salem, North Carolina
Karen Castonguay	Calumet Public Schools	Calumet, Oklahoma
Andy Evans	Kingfisher Middle School	Kingfisher, Oklahoma
Cliff Williams	Gateway Academy	Oklahoma, City, Oklahoma
Don Elkins	The About Face Academy/Save Academy	Sand Springs, Oklahoma
Linda Skaug	Century High School	Hillsboro, Oregon
Norma Madden	Anson Elementary	Anson, Texas
Doricell Davis	Dimmitt Middle School	Dimmitt, Texas
Diana Duncan	El Paso High School	El Paso, Texas
Ann Waggoman	North Central Texas	Gainesville, Texas
Samuel Ferguson	Hamlin Elementary	Hamlin, Texas

Kenneth Lane, O.D.	The Lane Learning Center	Lewisville, Texas
Sharon Richardosn	Comal I.S.D.	New Braunfels, Texas
Margie York	The York Learning Center	Gainesville, Texas
Cynthia Jacobson	Rusk Elementary	Midland, Texas
Kathy Holman	Permian Basin Rehab Center	Odessa, Texas
Jane Davis	Refugio Junior High	Refugio, Texas

Web References – When a "Google" search of the term "visagraph" was made recently, nearly 150 Visagraph references were found. Many of these matches refer to the several schools that are currently utilizing the Visagraph to measure a student's reading skills.

Historical Background

The history of eye-movements and their relation to reading dates back to 1879 and the studies of the University of Paris professor Emil Javal, who discovered that a reader's eyes do not sweep smoothly across a line of print but rather make a series of short pauses or saccades. Other early studies in eye-movements included an 1891 study conducted by Landolt who observed subjects eye-movements while they read different types of text. He discovered that, "Reading of a foreign language required more pauses as did also the reading of detailed words, numbers, and lists of proper names (24)" This provided evidence that the eyes do not proceed on a regular predetermined path. (37)

Studies by Dodge (10) and Dearborne (8) also revealed that people read in a series of eye stops or fixations as their eyes move along lines of print. Furthermore studies by Buswell(4), Taylor(51), Morse(33), Ballantine(2), and Gilbert(15)all show that eye-movement efficiency increases as the reader gets older. These studies also demonstrated that poor readers will tend to make more fixations, regressions and have a longer duration of fixations than good readers.

The earliest method of eye-observation relied solely on direct observation. In some instances a mirror was placed behind or above the reader, allowing the observer to count eye-movements (12, 25). In other instances telescopes, microscopes and magnifying glasses, and other means of magnifying the eye were used so the observer could more clearly see and count eye-movements (3, 13, 33). In 1928, Walter Miles (30) used a small peephole which was cut into the middle of the copy to read. The observer peered through the hole and counted eye-movements. All of these methods left the observer unable to detect and count the more rapid and

subtler visual movements. Further, no oculo-motor pattern could be studied or appreciated.

Another early method of recording eye-movements involved the use of mechanical contraptions such as levers, pneumatic capsules, a tambour with a protruding stem, and cups made of ivory, aluminum, rubber, and other materials. Ohm (35) in 1914 used levers that were placed against the sides of the eyeball. Eye-movements were amplified through additional levers and then recorded on smoked paper. Buys (5) laid pneumatic capsules over the eye-lid, which when moved compressed a capsule, which activated a tambour, and thus activated a recording stylus. Lamare (27) used a tambour with a protruding stem which was held against one eyeball. Two rubber tubes running from the tambour were inserted into the ears of the experimenter, who could hear changes in pressure caused by an eye-movement. Numerous experiments used cups of ivory (1, 9, 23). The cups were fitted to the cornea and had levers attached that activated a recording stylus. Another experimenter placed a mirror on the cup which reflected a beam of light onto a screen where eye-movements could be observed. Yarbus (56), in 1956, used suction cups that deflected rays of light to record eye-movements positions.

Eventually mechanical devices used to read eye-movements begat electrical devices. Lamare (27) used his tambour to break an electric circuit, which transferred changes in air pressure into sound. Carmichael and Dearborne (6) attached electrodes around the eyes of the subject, and the small amount of electric current generated by the moving of the eyes was received amplified and recorded with an ink writing oscilograph. While these methods were superior to previous methods, the electrical recording devices were at a disadvantage because of the electrical complexity and careful technique needed to maintain an accurate recording.

Photographic measures of eye-movements were also employed during the dawn of eye-movement study. Early methods included Judd (26) using small pieces or flakes of Chinese white pigment which were placed on the cornea of the eye. The face of the subject was photographed with a motion picture camera. The pictures were enlarged through projection and movement of the "eye-spots" plotted off to indicate movement of the eye.

A different photographic method employed a mirror, which was mounted into a spectacle frame, so it could be held against a closed eyelid. A bead of light was reflected from the mirror and recorded onto photographic film (10, 54)

The most widely used early method of eye-movement photography was the corneal reflection method. The earliest to use such a method was Dr.

Raymond Dodge (10,11). From the 1890's through the 1930's many corneal reflection cameras were built at various universities. For a more thorough analysis of these early devices see Taylor (49) *Controlled Reading*. Some of the earlier corneal reflection cameras included:

1903-1904 – Columbia University Camera, built by Dr. David Dearborn. It was used to secure the list of systematic study of eye-movements in reading. (8)

1905-1907 – University of Wisconsin Camera, designed by Dr. David Dearborn. The camera used a three-inch film about three feet long, propelled by a roller friction drive.

1910-1911 – University of Chicago camera designed by Dr. Clarence T. Gray and improved and modified by Dr. Timothy Buswell. The camera provided binocular photography. It was the first camera to use motion picture film.

1922 – Stanford University Camera designed by Dr. Raymond Dodge but re-modeled by Dr. Walter Miles in 1922. It used a length of a pan chromatic film instead of the falling-plate principal and recorded both horizontal and vertical movements (31).

1927 – University of Texas camera, designed by Dr. Clarence Gray in 1913-14 but remodeled by Dr. B. F. Holland (28)

1928 – University of Cambridge Camera designed by Miss M.D. Vernon (55)

1929 – The University of Nebraska Camera, designed by Dr. J.P. Guiliford (20)

1930 – University of Minnesota Camera designed by Dr. Miles Tinker. It was one of the most elaborate of the large cameras which had been constructed.(53)

1932 – Educational Laboratories, Brownwood Texas, James Y Taylor and Carl C. Taylor build the first portable monocular eye-movement camera

1932 – James Y. Taylor, Carl C. Taylor, and Earl A. Taylor invent the Opthalmograph, a portable binocular camera.

1933 – The University of Chicago Camera, built by Dr. Guy T. Buswell. The camera recorded both horizontal and vertical eye-movements on two separate films to study the perception of art.

In the 1960's head cameras were used to record eye-movements. Usually these cameras were used only in general observation and not in reading. In 1959, the Reading Eye I, using corneal reflection, was designed by Stanford E. Taylor (61) and was used extensively throughout the 1960's.

In the 1970's electronic devices were employed for the recording of eye-movements. These electronic devices worked by reflections of the limbus of the eye projected on photo diodes sensed changes in eye-movement positions producing variations in electrical voltage. Those voltage changes were amplified and used in conjunction with heated pen recordings. TV cameras were employed to photograph eye movements. Reflections of the change in limbus position were translated into varying voltages, which in turn were recorded as digital information by computer.

The Reading Eye II (32) or Eye Trac became one of the most widely used commercially available means of electronically measuring eye-movements in the 1970's.

Eventually as computer started to become an increasing part of daily life, they eventually became the method of choice from the late 1970's on. Computers were used principally in research situations to study the nature of oculo-motor activity, the span of recognition, and the effect of context on oculo-motor behavior. These studies are most comprehensively covered by Rayner (38) in his publication Eye Movements in Reading, Perceptual and Language Processes.

The Visagraph I designed by Stanford E. Taylor was released in 1985 and was the first eye-movement recording system to employ a microcomputer as a means of recording and analyzing oculo-motor performance during reading. The Visagraph II improved on the Visagraph I by using goggles that contain infrared sensors. This eliminates the effects of head movement and removes the need for calibration and alignment for each subject.

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B. CPA: Computerized (Reading) Placement Appraisal (All Levels)

Introduction

The CPA initially determines a student's Independent Reading Level (IRL). IRL implies very few vocabulary recognition difficulties and successful comprehension without assistance. CPA also measures a student's usual reading rate, evaluates comprehension capability in relation to independent reading level, and vocabulary mastery. CPA places students in the Reading Plus system automatically at the most appropriate levels in both reading content and appropriate vocabulary study levels. CPA can be used with students at all reading levels.

Administration of CPA

A student who is using CPA independently, without pre-assignment, will enter a grade level only. CPA would then present an initial reading test selection three grades lower than the student's grade. However, a teacher might choose to enter a student's reading level, which would dictate the initial reading selection level in CPA.

CPA can be administered in either of two forms. Form A is the principal form used to determine reading levels. Form B is used to reappraise a student's reading level if there is a questionable performance on form A. These two forms are not meant to be used as pre-post test measures in evaluating reading gains. Student gains are always measured through the use of standardized tests or Taylor Associates Visagraph.

The CPA consists of three major parts. The first part determines a tentative Independent Reading Level Rate. In this section students will read one to a maximum of seven 100-word reading selections depending on the starting level and scores achieved. After each section is read five literal comprehension questions follow. The level of the first 100-word selection is based on the grade entry, or perhaps the reading level entry by the teacher.

Part I – Literal Understanding

Each reading selection is comprised of two frames containing 100 words (approximately 50 words per frame). A timing loop is used to record the students reading rate on each selection read. Following the reading of the two frames, five literal comprehension questions (multiple choice) are presented (one question per frame).

The level of the second 100-word reading selection will be determined by the student's comprehension score on the first selection. A comprehension

score of 80-100% on the first selection would cause the computer program to present a test selection at the next higher level (and at later testing intervals, should the next higher level have already been read, the program would automatically present the next higher selection not read).

A comprehension score of 60% or lower would present a test selection one level below the initial selection. (At later testing intervals, if that selection had been previously read, it would automatically present the next lowest level test selection not previously read.)

Thus a student would continue to read test selections (a maximum of 7) until CPA determines the highest level read with a comprehension score of 80% or more.

Part II: Comprehension/Skills Level

Next a 300-word selection is read one level lower than the tentative Independent Reading Level determined in Part I. During the reading, the student's rate is likewise timed. Following the reading, 10 comprehension questions will be answered. If the student scores between 100 and 60% he/she will not need to read another selection. A comprehension score of 80% or above results in an assigned reading level equal to that tentative Independent Reading Level in Part 1. A 70% comprehension score results in an assigned reading level of one below the level established in Part I. A 60% comprehension score will cause CPA to assign the student an assigned reading level of two below the level established in Part I.

If the comprehension on the first 300-word selection is 50% or less, a second 300-word selection, 3 levels below Part I, will be read to provide additional perspective regarding the most appropriate independent reading level for a student. Furthermore should a student who read at a rate over 600 wpm achieve a comprehension score of below 60%, he/she will receive a second story that is 2 levels below Part I. If the student fails to achieve a 60% comprehension score on this second reading (2 levels below Part I), he/she will then receive a third selection 3 levels below his/her Part I level. An Assigned Reading Level will be displayed after reading one, two, or three 300-word selection(s).

The skill coded questions employed in Part II require the application of the following comprehension skills:

1. Main Idea
2. Predicting Outcomes
3. Drawing Conclusions
4. Making Inferences
5. Relating Information

6. Finding Significant Details
7. Comparing/Contrasting
8. Cause/Effect
9. Classifying
10. Analogies

The results of this 300 word selection of the appraisal evaluate the student's depth of comprehension, while reading material on his/her tentative independent reading level, and permit a confirmation or adjustment of the independent reading level indicated by Part I. Furthermore Part II will provide an indication of the independent reading rate flexibility of a student by comparing the reading rates of Parts I and II. The Independent Reading Level determined by CPA will provide the basis for level content assignments in the Reading Plus Guided Reading and Comprehension Power programs

Part III: Vocabulary Level

Finally a student completes twenty or more vocabulary meaning, definition or use items. The Part II Assigned Reading Level determines the initial level of vocabulary items.

A student might complete twenty items on a level and if four errors are made on that level, that vocabulary study level will be assigned. If less than four errors are made on that level, twenty vocabulary items on the next higher level will be presented. This process will be continued until four errors are made on a given level and that level will be assigned as a vocabulary study level in the Reading Plus, CLOZE PLUS, and Reading Around Words programs.

The CPA also offers a Perceptual Memory Appraisal (PMA) feature if a student is unable to achieve 60% or more on the lowest reading level of CPA (Reading Level 1.5). PMA is used to determine student's readiness for reading instruction. It determines a student's ability to discriminate letters and spatial awareness of letter order, as well as visual memory. PMA is automatically given to those who do not score well on CPA's 1.5 reading level selection. A teacher can also assign PMA to be initially administered to a student before CPA if there is doubt as to a student's readiness.

During a PMA test the student is shown single letters and then words of varied length. He/she will be asked to identify what was seen in each 3 second exposure. If a child scores low on the PMA, then special perceptual training must be provided with Taylor Associates Reading Plus PAVE, Word Memory and D-Code programs to develop adequate visual

discrimination and visual memory capacity in preparation for reading instruction.

Another optional feature of the CPA program is a decoding appraisal, which can be assigned after the reading portion of CPA is completed. A decoding appraisal is recommended for students who have a reading level of 1.5 – 3.5. During the decoding appraisal a student is presented with a target noun and he/she must click on the correct picture from an array of 3 pictures. The student will encounter a total of 30 words, in two blocks of 15 words. If he/she fails to answer 13 out of the first block of 15 correctly the decoding test stops. Students with poor decoding skills should be provided with Taylor Associates D-Code program to build more rapid and required decoding capability.

History and Pedagogical Background

The Computer Placement Appraisal Program was designed by Stanford E. Taylor and authored by George and Evelyn Spache. CPA was field tested and modified in field trials during a period of 1 ½ years with many schools and institutions contributing. The schools who participated were as follows:

School	**Location**	**Researcher**
Brownwood Junior High School	Brownwood, TX	Virginia Butler Reading Specialists
South Central School District	Seattle, WA	Marilyn Nilson Reading Resource Specialist
Idalou Independent School District	Idalou, TX	Joanne Flusche Reading Specialist
Adirondack Learning Association	Plattsburgh, NY	Dr. Michael Ritty
Channelview High School	Channelview, TX	Danna Fowler Reading Specialist
Worley Middle School	Mansfield, TX	Vera Scirratt Reading Specialist
Beaumont Independent School District	Beaumont, TX	Dorothy H. Henges Pam Goodman Reading Specialists
Cooke County College	Gainesville, TX	Ann Waggoman Director of Developmental Studies
	New Haven, CT	Dorothy E. Larsen Reading Coordinator
Rainbow Road Center for Human Potential		Susan Workman Jim Cage

CPA yielded very similar levels of independent reading. Some of the IRI's that the CPA was compared with include the Durrell Reading Analysis (1), Gray Oral Reading Test (2), and the Spache Diagnostic Reading Scales (3).

The reading test selections that comprise CPA were evaluated in terms of readability levels using the Spache Readability Formula on lower levels, and the Fry Readability Formula on the intermediate levels and beyond. The reading level designations of the selections indicated in the CPA manual cite these readability measures.

The Vocabulary study level, which is determined with CLOZE activities on reading levels 1-3 and word meaning entries on levels 4 and up, treats words taken from Taylor's Reading Plus graded, "Core" vocabulary (4). These entries were validated as reasonable predictors in terms of vocabulary placement during the developmental period. Vocabulary knowledge is very idiosyncratic, therefore the Taylor Associates CPA manual cautions that one must consider the CPA vocabulary placement level carefully to be sure that it is somewhat in accord with a student's independent reading level. Typically the vocabulary study level would be 1 to 3 levels higher than a student's independent reading level.

When CPA results have been compared with standardized reading tests, it has been typically observed that CPA placement is considerably lower than most standardized reading test results, since standardized reading tests do not measure "independent reading levels." Standardized tests typically measure "frustration reading levels" which are classically a minimum of two levels above a student's independent reading level.

Current Use and Research

Over 5,000 schools are presently using CPA, with over 3,000 of those schools using CPA in conjunction with Reading Plus. The following is a list of research briefs prepared by Taylor Associates in which schools have used the CPA program to determine a student's Independent Reading Level for instruction with Reading Plus. These briefs may be viewed in the research section of the Taylor Associates website www.ta-comm.com.

Brief #	**School**	**Location**
Brief # 14	Irving High School	Irving, TX
Brief # 18	Jackson Elementary	Lawrenceville, GA
Brief #20	Grovetown Elementary School	Grovetown, GA

Brief # 21	SUNY College of Optometry	New York, NY
Brief #22	Morgan County Elementary School	Madison, GA
Brief #23	City Park Elementary	Dallas, TX
Brief #26	Shields Elementary	Chicago, IL
Brief #29	Frank Stone Middle School	Paris, TX
Brief #30	Cooke Elementary School	Adel, GA
Brief #33	MacArthur High School	Irving, TX
Brief #34	Marysville Elementary School	Marysville, KS
Brief #35	Little Village Academy	Chicago, IL
Brief # 36	Carson Elementary School	Chicago, IL
Brief #37	Healy Elementary	Chicago, IL
Brief #38	Beebe Elementary	Beebe, AR
Brief #43	Rusk Elementary	Midland, TX
Brief #44	Pender High School	Burgaw, NC
Brief # 45	Talihina Junior High	Talihina, OK

Bibliography

1. Durrell, D.D. & Catterson, Jane H (1980) *Durrell Analysis of Reading Difficulty*, Third Edition, The Psychological Corporation

2. Gray W.S. et Robinson, H.M. (1967) *Gray Oral Reading Test*. Indianapolis: Bobbs- Merrill

3. Spache, G (1982) *Diagnostic Reading Scales*, CTB McGraw-Hill

4. Taylor, S.E. *Reading Plus Core Vocabulary*, Taylor Associates, Unpublished.

C. Fluency Development (All Levels)

Fluency, or the ability to read with sustained attention and concentration, ease and comfort, at adequate rates with good comprehension, was sorely neglected for decades, (39) but is now at the forefront of nationally recognized educational issues.

In addition to the focus on fluency of the recent "No Child Left Behind" legislation, The National Reading Panel (78), in an evidence-based assessment of the Scientific Research literature on reading and its implications for reading instruction, selected fluency for review and analysis based on, "a current concern that children are not achieving fluency in reading." They cite the results of the National Assessment of Educational Progress study (81) which indicates that 44% of a national representative sampling of 4th grade students were found to be disfluent. The same study strongly recognized the close relationship between fluency and reading comprehension. Thus, non-fluent readers have difficulty comprehending what is read. The National Reading Panel concluded that, "Children who do not develop reading fluency, no matter how bright they are, will continue to read slowly and with great effort." (78)

Reutzel and Hollingsworth (85) noted incongruity in the fact that there has been neglect of fluency instruction in schools, while at the same time so many reading authorities believe fluency training to be an important part of the reading curriculum. The National Reading Panel (78) has concluded that fluency, a critical component of skilled reading, is now generally acknowledged in the educational community, and its neglect in classroom instruction has, "Begun to give way as research and theory have reconceptualized this aspect of reading, and empirical studies have examined the efficacy of specific approaches to teaching fluency." This view has also been espoused by the National Research Council in its report, Preventing Reading Difficulties in Young Children (90). "Because the ability to obtain meaning from print depends so strongly on the development of word recognition, accuracy, and reading fluency, both should be regularly assessed in the classroom, permitting timely and effective instructional response when difficulty or delay is apparent.

The reactivation of a fluency focus in education is based on the realization that fluency encompasses more than simply word recognition.(69) The idea of fluency as the natural outcome of word recognition proficiency dominated much of the past century's research and practice. Although there is adequate research indicating that accurate word recognition, or automaticity, relates to both reading comprehension (66), (65), (71) and reading enjoyment (79), it is now more widely accepted that fluency is a much broader concept whose achievement is contingent upon many

factors. These factors include those that compose the Fundamental Reading Process, which reflects the manner in which we have adapted our visual/functional processes, acquired perceptual competence, and learned to process information; all subliminal activities that interrelate and function 3-5 times per second as a reader moves his/her eyes across a line of print.

In their initial approach to reading, students possess no Fundamental Reading Process. They bring to this stage of learning their vision, visual/functional skills, and certain acquired habits of observation. None of these competencies are typically adequate preparation for the physically unnatural and perceptually demanding near-point visual activity of reading with its intricate discrimination of letters and words. Adaptation then proceeds more or less successfully, based on a number of factors, including the adequacy of an individual's visual/functions skills (which affect both comfort and accuracy of perception), the number of new words introduced each week without training in instant recognition (which can result in a slow and halting manner of reading that interferes with comprehension), and the considerable amount of non-fluent oral reading experience as well as limited silent reading practice, all of which inhibit the development of silent reading fluency.

Because the Fundamental Reading Process employed in reading transcends conscious awareness, improvement can only be achieved through training techniques that allow the reader to focus on the message of the reading content under viewing conditions that will alter and improve the process through which one perceives and the manner in which short-term memory functions. Those techniques are the basis of Taylor Associates' Reading Plus fluency programs, whose success has been demonstrated and documented with thousands of students around the country over an extensive period of years.

1. Guided Reading (Levels 1-12)

Currently, 15 levels of Guided Reading are available for reading levels 1-12. This total includes 3 levels of mature, high-interest/low readability reading selections for secondary/adult beginning readers.

Goals of the Guided Reading Program

The goal of the Guided Reading program is to develop fluency (efficiency) in the visual/functional, perceptual and information processing capabilities that comprise the Fundamental Reading Process, resulting in ease and comfort, adequate reading rates and improved comprehension.

Guided Reading produces dramatic improvement in an individual's oculo-motor activity, as measured by the Visagraph Eye-Movement recording system. These improvements include:

- reduced fixations (eye-pauses) during reading
- reduced regressions (reverse eye-movements)
- increased span of recognition (word(s) parts perceived in eye-pause)
- decreased duration of fixation
- increased rate of reading
- improved directional attack
- heightened comprehension

Nature of Training with Guided Reading

Students begin Guided Reading on easy to read content, typically one year below their independent reading level. Appropriate starting levels can be assigned by the teacher or ascertained and assigned through Taylor Associates' CPA: Computerized Placement Appraisal. Available Guided Reading stories encompass a wide variety of subjects including literature, adventure, sports, biography, career/consumer awareness, life adjustment, and many other subjects.

To begin, a student reviews key words, which may optionally be flashed or typed. Selections on levels 4 and up are preceded by a preview in preparation for reading. The first portion of the selection (Part A) is read in a self-paced manner. The second portion (Part B) of the story in which the student has been immersed, is then presented in a timed, left-to-right guided manner at reading rates of 299 wpm and below, and in a line-by-line manner for rates of 300 wpm and above. Every selection is followed by 10 skill-coded questions, each addressing one of twenty-five major comprehension skills. Incorrect responses return the student to the appropriate sections of the text for re-reading before offering a second attempt to answer the question. At the conclusion of each lesson, the student is presented with a report of rate and comprehension on the current lesson as well as on the previous 5 lessons to assess progress. Cumulative records of reading rates, comprehension percentages and comprehension skills are automatically maintained in management.

History

Computerized Guided Reading is the latest development in a long series of "controlled reading" offerings that commenced in the 1930's with the Metronoscope (99). Between 1960 and 1980, over 240,000 schools benefited from the use of Taylor's Controlled Reading and/or Guided Reading projection devices. Technological advances led to Taylor's

development of the Guided Reading computer program, which is currently being used by over 3,000 schools around the country. In total, use of Taylor's programs over the last 50 years is estimated to exceed 50 million students.

2. PAVE: Perceptual Accuracy/Visual Efficiency (All levels)

Goals of the Pave Program

The PAVE program may be used with a wide range of students and adults with various training objectives. Beginning readers of any age can, for example: build more rapid number and letter recognition; acquire an awareness of proper spatial orientation; acquire effectiveness and efficiency in the visual/functional skills and perceptual accuracy that underlie efficient reading and learning. College students and adults can develop greater accuracy in dealing with alpha-numeric combinations and build proficiency in seeing, remembering, and transferring such data while acquiring the visual/functional skill that facilitates high-speed reading and skimming/scanning competency. Students of any age can "re-learn" the perceptual skills that serve as the basis for improved spelling, content area, and general vocabulary recognition, as well as improve the basic visual/functional skills that affect fluent silent reading.

The Nature of PAVE Training

While most students will engage in both Perceptual Accuracy (Flash) and Visual Efficiency (Scan) training, the option to engage in either one or the other is available. Should only one form of training be undertaken initially, the other can be added at any time. If both forms of training are employed, Visual Efficiency training is encountered first during any PAVE training session.

The first step in Scan Training is a test to determine the optimum training rate for each student. A student is offered 1-5 number Scan exercises during which the rate of Scan changes, based on the accuracy of student response. (If a response is correct, the scan rate will increase by 10 lines per minute, and if a response is incorrect, the scan rate will hold constant. If the response is incorrect a second time, the rate will drop by 5 lines per minute.)

Each exercise of the Scan Test presents a target number followed by the appearance of 3 random numbers per screen, presented in a left-to-right manner, at predetermined rates. Every time the target number appears, the student either presses the spacebar, for the computer to store responses, or silently counts the number of appearances of the target word and enters the number at the end of the sequence.

The rate range for students K-1 is 10-60 lines per minute with an initial rate of 20 lpm, or 1 second per element scanned.

The rate range for grades 2-4 is 10-70 lpm with an initial scanning rate of 30 lpm, or .66 seconds per element scanned.

The rate range for grades 5 through adult is 20-80 lpm, with an initial scanning rate of 40 lpm, or .5 seconds per element scanned.

After the Scan Test, Scan Training begins. Randomly assigned numbers and uppercase or lowercase letters are presented at increasingly higher rates. The goal is to achieve a scan rate that equals or exceeds two times the desired reading rate performance per line. (Example: 80 lines per minute equals a reading performance of 480 words per minute.)

The first step in Flash Training is a Flash Test to determine the optimum number of elements to be flashed during the first training session. During the test, ten number exposures are presented and student responses are stored.

For Kindergarten through grade 1, three numbers are flashed twice (at 1/10 of a second each). Three foils are presented, and the student uses the appropriate one as a guide in typing the correct response and then presses the Enter key. The correct number sequence will reappear, leaving blanks where any incorrect numbers may have been entered. The student must then type in the correct numbers as they appear on the screen.

For grades 2-4, four numbers are flashed twice (at 1/10 of a second each). The student types what was flashed, from memory, and presses the Enter key. The correct number sequence will reappear, leaving blanks where any incorrect numbers may have been entered. The student must then type in the correct numbers as they appear on the screen.

For grades 5-adult, five numbers are flashed one time (at 1/10 of a second). The student types what was flashed, from memory, and presses the Enter key. The correct number sequence will reappear, leaving blanks where any incorrect numbers may have been entered. The student must then type in the correct numbers as they appear on the screen.

After the Flash Test is completed, Flash Training begins. The number of numerals that were typed in correctly, in the correct position, during the 10 exposures of the Flash Test serves as the basis for the number of elements to be presented during the initial Flash Training lesson.

Once the optimum number of elements has been determined, the student will either choose, or be assigned by a teacher, to train using numbers, uppercase letters or lowercase letters.

Flash Training follows the same format as the Flash Test. After ten exposures (the typical amount undertaken during a PAVE session), the total correct determines the number of elements which will be presented during the next lesson. A student is permitted 2 errors out of each series of 10 to advance to training with one more element than is easily seen.

The goal of Flash Training is to develop the ability to see and repeat a desired number of elements in a single fixation, thus facilitating the retention of words in continuous reading as well as spelling.

History

The scan and flash techniques employed in the PAVE program have a long history of endorsement, starting principally after the 1940's, when airplane and ship recognition techniques were employed during World War II (24). Other early uses of tachistoscopic training include orthoptics (37), business education (36), and physical education (11), in addition to use in the recognition of forms and shapes (25) and the development of word recognition (16), (20), (21), (02). In all of these situations, the potency of intense attention, combined with reorganization of perception, has been demonstrated.

Endorsement of the tachistoscopic techniques employed in PAVE can be broken down into two components: Perceptual Accuracy training and Visual Efficiency training.

Perceptual Accuracy Training

Attention is one of the first skills to improve during tachistoscopic or "flash" training. Students learn to focus and sustain attention which, as Earmes (53) stated as early as 1959, is "Always important in learning." Attention appears to be a state of sensitized consciousness in which an incoming impulse introduces a kind of resonance pattern, and perpetuates it through some form of circular reflex. The intense stimulus of tachisto-scopic flashes, combined with a high level of attention prior to exposing material at $1/10^{th}$ of a second or shorter intervals, conditions the ability to focus and maintain attention at extremely high levels.

More recently, a number of reading authorities have recommended tachistoscopic perceptual training for beginning readers. Pollack and Pollack (82) stated:

> "The limits of usefulness of the tachistoscope have scarcely been tapped. There is no doubt that the training with this device increases visual capacity and accuracy. Perception, in this regard, means noting and holding in the mind an accurate representation of the flashed image. The mind must react quickly and accurately to the impulses presented by the eyes. The flashed images must be retained, and in as much as a lack of visual retention is one of the problems frequently facing the beginning reader, the development of this skill is essential to satisfactory progress."

Solan (91) strongly hypothesized that:

> "The tachistoscopic exposure test using three digits at 0.1 and 0.01 seconds distinguishes, at an early level, those youngsters whose visual sensory motivation is lagging." Solan further stated that, "There seems to be general acceptance of the tachistoscope as a methodology among specialists in the teaching of reading."

Renshaw (25) reports that, "Tachistoscopic training with digit patterns produces a marked increase in reading comprehension and speed measured by standardized tests." In two of Renshaw's studies, there was an average gain of 26 percentile points in comprehension.

Tachistoscopic training with numbers and letters uniquely prepares readers, especially beginning readers, for more rapid and accurate recognition of words. Taylor states these training characteristics:

> "First, exposures of non-related number and letter combination units (which cannot be "chunked" into larger sound or meaning) require careful, accurate scrutiny on the part of the student. Each element must be realized in proper spatial order from left-to-right. This process has been referred to as "internal scan." The intensive emphasis on orderly seeing builds a strong spatial orientation on the part of the viewer, a perceptual sequential readiness for more accurate recognition and retention of the letter configurations of words. Realize that tachistoscopic "flashes" lasting one-tenth of a second of less, do not allow the viewer's eyes to move over the exposed material during an exposure. As a result, what is seen must be derived from a single fixation (eye-stop). Thus, this training encourages a viewer to derive from each fixation."

Durrell (52), who included a tachistoscopic test in his "Analysis of Reading Difficulties" reported, "If a word is to be read smoothly in phrases, it must be recognized accurately in one-tenth of a second or less." Bond and Tinker (43) referred to tachistoscopic exposures as a means of correcting word recognition difficulties. "A few such indications of

limited ability in recognizing words at a glance would make remedial work in developing the habit of rapid identification and building a larger sight vocabulary."

Visual Efficiency Training

Visual efficiency during reading can be described as the ability to rotate the eyes horizontally with ease and comfort while moving across lines of print with accuracy, and the ability to execute efficient return sweeps. These are basic prerequisites unique to the reading process.

The following references address these needs for well-developed visual/functional skills:

Taylor, E.A. and Solan, H.A. (100) urge the development of visual efficiency:

> "Teachers can do a great deal in the classroom to develop and improve reading and visual efficiency of the pupils…Visual experiences can be made more meaningful with careful guidance. Most individuals can be trained to see more easily, more rapidly, more accurately, and more objectively. Much can be done with short-exposure training (using both slow and fast exposures), and a reading instrument which controls directional attack, discourages regressions and conditions more accurate return sweeps."

Earl Taylor (30) stated:

> "Reading requires that the individual give attention to the task with his whole mind and body, while at the same time, he uses a number of acquired mechanical and interpretive skills… Reading efficiency is not only dependent upon the ability to see and interpret printed materials, but also the ability of the individual to use his two eyes together effectively, make the necessary rapid ocular rotations, and sustain effort during extended periods of near-point application…."

A.L. Gates cautioned:

> "In reading, a definite direction must be habituated to permit accurate perception. That the direction must be from left to right across the line has been recognized. This rule is rather unique in visual perception. That pupils need to be taught and guided in forming the habit of moving the eyes consistently along the line from left to right, is now obvious. Children who do not learn to do this in the initial stages of reading are certain to encounter serious difficulty in learning…Actually, the consistent left-to-right

> procedure is very unnatural in the sense that it has been rarely, if ever, required in any other perceptual activities engaged in by the child. Hence, the need for careful guidance."

Storm and Smith (97) emphasized:

> "The task of the school is plainly that of converting the raw material of the child's short, irregular regressive movements and long pauses into the refined habits of the good, mature reader which are characterized by the eye moving across the page in a series of broad rhythmical movements, pausing for a fraction of a second at regular points along the line to gather up as many words as possible at a glance, proceeding on to the end of the line with no regressive movements, and returning to the beginning of the next with accurate return sweeps."

Visual Efficiency Training with Taylor Associates' PAVE program provides precise control over the development of the visual/functional skills inherent in the reading process. The horizontal tracking across lines of widely spaced elements encourages more precise visual functions, accuracy of fixations (eye-stops), better coordinated binocular horizontal eye-movement and, as excursion rates increase, ocular motility (the ability to rotate one's eyes rapidly with ease) improves.

The need for improved visual efficiency is obvious at the beginning reading stage, but the need, in reality continues through the intermediate and secondary stages and, indeed into adulthood, if such visual skills were never effectively developed and mastered. Thus, it is not unusual to find Visual Efficiency training provided in reading labs and reading improvement courses for adults as well as for younger individuals.

Visual Efficiency training, as a classroom technique, was introduced in the early 1930s with the development of the Metronoscope (29), a triple-door, left-to-right exposure device designed to improve efficiency. This form of training was considerably expanded with the introduction of the Controlled Reader projector (102) in 1954, and later the Guided Reading projector in 1974 (104). Then, in the 1980s, Guided Reading became available in computerized form for individualized training with computerized control over the training illusions based on a student's accuracy and success. PAVE, likewise, became available in computerized form during the 1980s.

Current Research

The following are excerpts from research briefs prepared by Taylor Associates using data provided by schools around the country. Complete briefs are available on Taylor's Web site: www.ta-comm.com.

Research Brief 13
Pilot Study at Irving High School, Irving, TX
Results: Gains averaged 2.8 in Grade Level Equivalent as measured with the Visagraph after only 11-20 sessions of Guided Reading (far fewer than the recommended 40 lessons) over a 3-4 week period.

Research Brief 15
Pilot Study at East Middle School, Great Falls, Montana
Results: All students involved in the pilot program were considered "at risk." A control group of additional "at risk" students was also established to judge the effectiveness of the Guided Reading program. The results of the first year of thepilot indicated that Reading Plus students out-ranked the control group in vocabulary, comprehension and total reading on the Iowa Test of Basic Skills by more than one year. The pilot students exhibited gains of approximately 4.2 in Grade Level Equivalent as measured with the Visagraph.

Research Brief 16
Pilot Study at Kennedy Middle School, Hays, Kansas
Results: Gains averaged 1.8 in Grade Level Equivalent as measured with the Visagraph after an average of 31 Guided Reading sessions over 3-4 months.

Research Brief 17
Preliminary Report – Woodville Elementary School
Results: Gains averaged 1.26 in Grade Level Equivalent as measured by the Visagraph, although students completed far fewer than the 40 sessions recommended by Taylor and were not able to observe the 2-3 sessions per week which are also recommended.

Research Brief 18
Preliminary Report – Jackson Elementary School, Lawrenceville, Georgia
Results: The preliminary study targeted students who had not made reasonable improvements with more traditional forms of reading tutoring. Gains averaged 0.74 in Grade Level Equivalent as measured with the Visagraph after only 25.8 Guided Reading sessions at an average of 5.7 sessions/month (fewer than 2 sessions recommended per week, and the 40 total recommended lessons). Students showed marked improvements in

reading skills although they had not completed the recommended 40 sessions of Guided Reading.

Research Brief 20
Study – Grovetown Elementary School, Grovetown, Georgia
Results: Gains averaged 2.9 in Grade Level Equivalent as measured with the Visagraph; substantial national percentile rank gains were exhibited on the ITBS standardized test, particularly for reading skills (+11). Students participated in 3 sessions per week for 8 months.

Research Brief 21
Pilot Study conducted under the supervision of Harold Solan, O.D., M.A., Distinguished Service Professor, State College of Optometry, State University of New York
Nine 6th grade students, averaging 2 years below the mean on the Gates-MacGinitie test, and all identified as reading disabled, were enrolled in 12 one-hour sessions using Taylor's Comprehension Power and CLOZE-PLUS programs, followed by 12 one-hour sessions of Guided Reading and PAVE. Training took place between October and May.

Results: Gains averaged 1.7 Grade Level Equivalent as measured by the Visagraph. A 342% increase in comprehension, as measured by the Gates-MacGinitie test, was also achieved.

Research Brief 22
Longitudinal study – Morgan County Elementary School, Madison, Georgia
Results: Gains averaged 2.7 (Grade 4) and 4.1 (Grade 5) in Grade Level Equivalent as measured with the Visagraph over a period of two years; substantial reading gains on the ITBS standardized test (+2.5) over a period of two years.

Research Brief 23
Pilot Study – City Park Elementary School, Dallas, Texas
Results: Over a 5 month period, a group of 18 students, classified as low achievers, improved by an average of 1.5 on Grade Level Equivalent with 40 sessions of Guided Reading and exhibited substantial improvements in Rate with Comprehension, as measured by the Visagraph.

Research Brief 24
Pilot Study – Twiggs County, Georgia
Results: Gains averaged 0.9 in Grade Level Equivalent, an improvement of 50%, with most students receiving substantially less than 16 hours of instruction with Guided Reading, PAVE and Word Memory.

Research Brief 26
Pilot Study – Shields Elementary School, Chicago, Illinois
Results: Grade 8 students improved by an average 2.3 Grade Level Equivalent with 40 twenty minute sessions over a period of 2 months as tested by the Visagraph. They also improved by an average of 1 year and 4 months on ITBS scores. Grade 6 students improved by an average 0.9 in GLE as measured by the Visagraph and an average 1 year on ITBS scores. Students in the study were primarily at-risk and bilingual.

Research Brief 27
Pilot Study – Statesboro High School, Statesboro, Georgia
Results: Students improved by an average of 6.0 grades (Grade Level Equivalent as measured by the Visagraph) with 45 to 50 30-minute sessions over a 10 month period.

Research Brief 29
Pilot Study – Frank Stone Middle School, Paris, Texas
Results: Seventy-seven percent of the Students in the Special Ed. group showed gains in GLE, as measured by the Visagraph, averaging more than 2 years, with a range of between 2.3 and 10 years. Average Fixations decreased by 34%, average Regressions decreased by 43% and Average Rate with Comprehension (wpm) increased by 38%.

In the second group of students, all of whom failed the reading section of the TAAS the preceding year, the average increase in GLE as measured by the Visagraph was 1.9 years. Average Fixations decreased by 62, Regressions decreased by 22 and Average Rate with
Comprehension (WPM) increased by 41.

Both groups completed 40 lessons; however, they had only 1 session per week, rather than the 2-3 recommended lessons.

Research Brief 30
Pilot Study – Cook Elementary School, Adel, Georgia
Results: Students gained an average of 2.0 years in Grade Level Equivalent as measured by the Visagraph in 50, twenty minute sessions. They also showed an average increase of 0.8 years on the reading component of the ITBS.

Research Brief 32
Pilot Study – Indiana Wesleyan University
Results: In Critical Reading Class #1, students demonstrated an average increase in GLE, as measured by the Visagraph, of 4.3 with a range of 0.7 – 11.6 years. In Critical Reading Class #2, students demonstrated an average increase in Grade Level Equivalent as measured by the Visagraph, of 4.6 years, with a range of .06 – 9.8.

In the Speed Reading Class, the range of Grade Level Equivalent increase, as measured by the Visagraph, was 0.4 – 10.5, with an average increase of 3.0 years.

Research Brief 33
Pilot Study – MacArthur High School, Irving, Texas
Results: Grade Level Equivalent, as measured by the Visagraph, improved by an average of 3.0 years in approximately 29 sessions of 30 minutes over a period of 5 months (below the number of sessions recommended).

Research Brief 34
Pilot Study – Marysville Elementary School, Marysville, Kansas
Results: Grade 2-3 students, who completed 25-30 Guided Reading lessons over a 5 month period exhibited an increase of 1.1 years in GLE as measured by the Visagraph. Grade 4 students, who completed 35-40 lessons over the same period, showed a gain of 2.2 years in GLE as measured by the Visagraph.

Research Brief 35
Little Village Academy – Illinois
Results: Students using Reading Plus 3 times per week, for 45 minutes, over a 3 month period exhibited an ITBS grade level advance (average) of 1.70, more than double the average increase in grade levels from the previous year when Reading Plus was not used.

Research Brief 36
Carson Valley Elementary School – Illinois
Results: Of the 20 at-risk and bilingual students using Reading Plus in 50 minute sessions over 4 months, 80% gained one year or more in grade level on the ITBS test. The average increase was 1.64 years.

Research Brief 37
Healy Elementary School – Illinois
Results: The test group, composed of thirteen 7th and 8th grade Special Education students, experienced an average reading gain of 1.58 years on the ITBS test, a 90% improvement over the previous year's improvement of .83 years. Students participated in 4 twenty-five minute sessions per week over a 7 month period.

Research Brief 38
Beebe Elementary School – Arkansas
Students worked 30 minutes daily with 3 sessions of Guided Reading and PAVE per week for approximately 3 ½ months. Students also completed 1 session per week of CLOZE and 1 session of Comprehension Power.

Results: The project group outperformed the control group across all Visagraph measures and in the Stanford 9 standardized test. The overall average in Reading Comprehension for grade 2 students in the Project Group on the Stanford 9 test was +5.7, while the average for the control group was -4.7, a difference of +10.4. For 3rd grade students, the results showed a difference of 10.2 between the Project Group and the Control Group.

Research Brief 39
Northeastern Junior College – Sterling, Colorado
Results: Two remedial reading classes completed an average of 24 Guided Reading stories and 8 sessions of PAVE over an 8 week period. Classes exhibited increases of 3.5 and 4.2 year's gain, respectively, in Grade Level Equivalent as measured by the Visagraph, and all students also showed improvement in all other measures of oculo-motor performance.

Research Brief 40
Indiana Wesleyan University – Marion, Indiana
Results: Overall, 65% of the students in the Critical Reading classes saw their Nelson Denny Comprehension scores improve (average improvement 12.2%) and 76% of these students saw their ND Vocabulary scores increase (average increase .8%). Additionally, 60% of the students improved more than 3 grade levels as measured by the Visagraph.

Research Brief 41
Indiana Wesleyan University – Marion, Indiana
All students involved in the testing were from an optional Speed Reading class in preparation for graduate school. Their instruction with Guided Reading and PAVE consisted of 36 sessions over a period of 3 months. The median increase in Rate with Comprehension, as measured by the Visagraph, was 180 wpm. The following components of the Fundamental Reading Process, as measured by the Visagraph, also showed improvement: GLE (average increase of 44%); number of fixations (average decrease 42.4%); average regressions (74.0% decrease).

Research Brief 42
National Learning Systems (independent learning center offering tutoring services to students from diverse backgrounds) – Oklahoma City, Oklahoma
Results: Students (18% elementary, 43% middle school, 2% college) worked with Guided Reading and PAVE for 2 hours, 3-5 days a week, for a total of 30 hours. Average gain in Grade Level Equivalent, as measured by the Visagraph, was 4.8 levels, or 42%.

Research Brief 43
Rusk Elementary School – Midland, Texas
Results: After 23 weeks of 2-3 twenty-five minute sessions per week using Guided Reading and PAVE, gains in GLE, as measured by the Visagraph, averaged 2.9 levels (or 46%) for 4th graders and 2.7 levels (or 43.6%) for 5th graders. Significant improvements were also noted in other components of the Fundamental Reading Process, as measured by the Visagraph. Additionally, strong gains were made in TAAS performance when compared with statewide averages.

Research Brief 44
Pender High School – North Carolina
Results: Ninth grade students completed the suggested 40 sessions of Guided Reading over a period of 2 ½ months. PAVE was also used during the period. Students displayed strong improvements in the North Carolina Competency Test, with reading scores that jumped from an average of 149.0 (seven points below the eighth grade proficiency level and 13.7 points below the state average) to 153.8. Students made up nearly 70% of the difference between the average score and the competency standard in less than 3 months.

Research Brief 45
Talihini Junior High School – Oklahoma
Twenty-two remedial 7th, 8th and 9th grade students, in addition to their normal reading instruction, received 30 minutes of training with each Comprehension Power, CLOZE-PLUS and Reading Around Words for approximately 9 months. Students also received limited training in Guided Reading and PAVE weekly.

Results: The average Iowa Test of Basic Skills (ITBS) grade level improvement was 1.6 grade levels, with scores advancing from 4.9 on the March 2000 ITBS test to 6.5 on the March 2001 test. This grade level improvement represents an increase of 129% from the students' average yearly advancement of 0.7 grade levels in the years prior to instruction with Reading Plus.

Prior Studies

1. Arundel, Reb. Eusebius. "Controlled Reading at Siena College." Catholic Educator 28:98-105; September 1957.

   In this anecdotal report, the author describes the implementation of the Tach-X and the Controlled Reader, and points out the purpose and value of both in the Controlled Reading program at Siena College over a three-year period. He concludes that, "Though every

year we work with more and more youngsters who show almost every type of reading disability, we have maintained a steady advance in the average reading gain for a given period of time. This average gain for fifteen ninety-minute classes has increased 75% since the adoption of controlled reading."

2. Beckley, Larry L. The EDL Controlled Reader in an Accelerated Primary Reading Program. (A Thesis for MS in Education Degree, Winona State College, Winona, Minnesota, July 1963.) EDL Reading Newsletter No. 34 New York: EDL/McGraw-Hill, December 1964. 12 pp.

   A two-year study, starting in the second grade, had as one of its purposes to determine the effectiveness of the EDL Controlled Reader in the primary Reading program. The investigator concluded that the Controlled Reader helped correct poor readinghabits by helping students develop proper left-to-right eye-movements. The instrument helped reduce the number of fixations per line, regressive eye movements, lip reading, and oral silent reading. The author further concludes that the Controlled Reader, when properly used, is a valuable tool in accelerating the rate and efficiency of reading by primary children.

3. Bottomly, Forbes. "An Experiment with the Controlled Reader." Journal of Educational Research, Vol. 54, No. 7 (March 1961). Also EDL Research and Information Reprint No. 3 New York: EDL-McGraw-Hill, 1967. 8 pp.

   This experiment involved 460 pupils in the fifth and eighth grades of two Spokane Elementary schools, one from an upper-middle socioeconomic neighborhood and the other from an upper-lower socioeconomic neighborhood. The researchers concluded that the Controlled Reader demonstrated promise for inclusion in the regular developmental reading program. Its major points of potential for the Spokane schools were to 1) boost reading speed, 2) use with average or better achievers who do not read sufficiently rapidly, 3) include as a natural element of the long-term developmental reading program, and 4) boost reading speed of pupils in the lower socioeconomic areas. Interestingly, post-test gains five months after the conclusion of the controlled reading program demonstrated the existence of latent gain and the long-term benefits of controlled reading.

4. Backen, Dorotny Kendall. Visual Skills and Primary Reading. EDL Reading Newsletter No. 32, Huntington, N.Y: Educational Developmental Laboratories, March 1964.

This paper examines the crucial role of the visual skills in early reading success.Three visual areas are discussed: visual acuity and functioning, visual discrimination and visual memory, and directional attack, and how tachistoscopic training and Controlled Reading can be used to develop improvement in these visual skills.

5. Bradley, Robert A. "What Effect Does the Use of the Controlled Reader in a Remedial Reading Program Have Upon the Improvement of Reading Skills." Research paper prepared for Florida Atlantic University, June 1967, by Robert A. Bradley, Head, Reading Department, Miami Military Academy.

6. Brickner, Ann, and Donal R. Senter. Reading Rates Attained By First-Year LISTEN LOOK LEARN STUDENTS. EDL Research and Information Report No. 2. New York: EDL/McGraw-Hill, February 1969. 12 pp

   This study examines the reading rates achieved by 664 first-year students using Listen Look Learn, EDL's communication skills system in which the use of instrumentation is a fundamental component. ("Cycles completed in the LLL system reflect the amount of instrument use to which the children have been exposed.")

   These data are compared with available norms for first-year students "who have had no instrument use as a part of their reading instruction." The authors' findings indicate that the students who used Listen Look Learn as a language arts program read, "at rates beyond those reported for the norming sample and that reading rate achievement may be, in large part, a function of instrument use since rate increases appear to be consistently related to LLL cycles completed." It should be noted that, for the sample of children who used the LLL system, "the average reading rate attained with comprehension was 137.5 words per minute as determined by Controlled Reader dial settings." This average was within the range of 125-175 words per minute which is the rate at which children entering school speak and listen. In a study described in EDL Research and Information Bulletin No. 3, it was reported that children do not usually reach this rate in reading before mid-third to mid-fifth grade. Based on this finding, the authors conclude: "It may be inferred that instrumentation, if used to best advantage, can aid primary grade children to attain reading rates more nearly consistent with their usual speaking and listening rates."

7. Brown, C. B., "Teaching Spelling With a Tachistoscope," English Journal, 40, 1951, p. 104-105.

8. Brown, J. I., "Vocabulary Via Tachistoscope: A Visual Approach to Improved Reading Ability," Educational Screen, 30, 1951, pp. 274+.

9. Buswell, Guy T. Remedial Reading at the College and Adult Levels. Supplementary Educational Monographs, No. 50. Chicago: University of Chicago Press, 1939. 72 pp.

   An experiment was conducted with remedial readers to discover in what manner and to what extent improvement could be made in five areas which seemed to be of major importance in the reading process. The five areas were 1) vocalization, 2) vocabulary, 3) span of recognition, 4) speed of recognition, and 5) regularity of reading (consistency of fixations and fewer regressions). The subjects were college students and adults whose comprehension scores were satisfactory at the onset of the experiment. Therefore, the gains revealed were in the reading process. A film projector which was used in this study proved to be of value in widening the span of recognition, reducing the duration of fixation, producing greater regularity in reading and improving the rate of reading.

10. Dailey, Gertrude W. "An Investigation of the Merit of the Controlled Reader in Grade One." Thesis presented to the graduate faculty of Paterson State College, Paterson, New Jersey, January 1965. 61 pp.

11. Damron, C. F., "Two and Three Dimensional Slide Images Used With Tachistoscopic Training Technique in Instruction High School Football Players in Defenses." Research Quarterly, 26, March, 1955, p. 36- 43.

12. Dearborn, Walter F., and Irving H. Anderson. "Controlled Reading by Means of a Motion Picture Technique." Psychological Record 2:219-27; 1938.

13. Emerson, Marle Mardesich, "Effective Uses of the Controlled Reader and the Tachistoscope in the Middle Elementary Grades," Thesis presented to the faculty of the School of Education in partial fulfillment of the requirements for the degree of Master of Science in Education, pp. 1-114, June, 1961.

14. Frackenpohl, Helen. Motility Training. (Paper delivered at the Fourteenth Annual National Reading Conference, Southern Methodist University, Dallas, Texas.December 5, 1964.) EDL Research and Information Bulletin No. 7. New York:EDL/ McGraw-Hill, 1965. 8pp.

Thirty-one subjects of varying ages were involved in a study to determine how they would perform and react to a form of Controlled Reader training emphasizing visual-functional performance. Nine eye-movement photographs for each individual were taken and analyzed.

15. Gelzer, Austin, and Nicholas J. Santore. "A Comparison of Various Reading Improvement Approaches." Journal of Educational Research, Vol. 61, No. 6 (February 1968). Also EDL Research and Information Reprint No. 20. New York: EDL/McGraw-Hill, 1968. 14 pp.

    The purpose of this study was to compare a number of devices and practices commonly used to increase rate and comprehension in secondary level reading programs. Specifically, a comparison of the Controlled Reader using its left-to-right guided slot was made with devices and practices providing pacing only. One group used the EDL Controlled Reader with a "guided slot; the second group was trained with the Controlled Reader with open or "free reading" slot; the third used the Shadowscope Accelerator with a band of light; the fourth used the Rateometer; and the fifth used Timed Reading. The subjects were 159 ninth-grade students. The authors concluded that a) while all techniques produced significant increases in rate scores at the end of the training period, the group using the Controlled Reader with the guided slot showed the greatest retention of rate gain eleven months after training, and b) in a comparison of reading performance as measured by eye-movement photography, the Controlled Reader (guided slot) group showed the greatest improvement.

16. Hamilton, B. F., "Flash Meter: An Instrument for Teaching Reading," Elementary English Review, 23, 1946, p. 272-275.

17. Heflin, Virginia B. "Is There a Relationship Between the Use of Reading Machines and Psychological Stress?" Proceedings of the College Reading Association 6:19-30; Fall 1965.

    This paper states that evidence to date indicates that "instrument techniques using appropriate materials, properly applied, have the decided effect of reducing emotional and physical stress…."

18. Hetrick, William M., and F.R. Wilson. "The Use of the EDL Controlled Reader at Lincoln School." E.S.E.A. Evaluation Report of the Monroe (Michigan) Public Schools, April, 1968.

19. Hoffman, Paul A. "Outcomes of Controlled Reading." Clearing House 37:90-91; October 1962.

This paper reports on a one-year study in which the EDL Controlled Reader and Tach-X were used with seventh-,eighth-, and ninth-grade students who were "below grade level," but whose "general intelligence was considered average." Control groups on the seventh- and eighth-grade levels received traditional reading instruction.

Constant observation of the experimental groups indicated that students were improving in attention and concentration. There was an increase in the speed of reading with a commensurate increase in comprehension. A comparison of pre-and post-Iowa Silent Reading Test results revealed that the eighth-grade control group showed an increase in percentile rank of 12.1 percent. The eighth-grade controlled reader experimental group showed an average increase of 21.1 percent. The ninth-grade experimental group showed an average increase in percentile rank of 22.5 percent. On the seventh-grade level, the traditional class showed an average increase of 10.4 percent; the Controlled Reader group increased 10.3 percent. Teachers who met both seventh-grade groups attributed the lack of significant difference to the Controlled Reader group's emotional instability. The author concludes that, overall, "the measured results seemed to indicate great improvement." Plans were to extend the offering of Controlled Reading as a consequence.

20. Keystone View Company, The Keystone Tachistoscope, Meadville, Pennsylvania: Keystone View Company, 1946, pp. 28.

21. MacLatchy, Josephine, "Bexley Reading Study," Ed. Res. Bull., XXV, September 18, 1946, p. 141-168.

22. Malone, James Franklin. "The Relative Effectiveness of Controlled Reading Versus regular Classroom Instruction in Rate and Comprehension with Selected Eighth Grade students," dissertation presented to the Graduate Council of the North Texas State University in partial fulfillment of the requirements for the degree of Doctor of Education, Denton, Texas, pp. 1-97, August, 1964.

23. McDowell, Heill A. "Effectiveness of the Controlled Reader in Developing Reading Rate, Comprehension and Vocabulary as Opposed to the Regular Method of Teaching Reading." Journal of Experimental Education, 32 (Summer, 1964), 363-69.

24. Neville, Leslie H., (editor), "Split-Second Recognition - A New Allied Weapon," Aviation, 42, 1943, p. 383-385.

25. Renshaw, Samuel, "The Visual Perception and Reproduction of Forms of Tachistoscopic Methods," J. Psych., 20, 1945, p. 217-232.

26. Ruck, William E. "A Program to Improve Reading Skills of Mainstreaming Students at the Secondary Level." A research study conducted at the School of Eucation/Psychology, Southern Oregon State College, February – May 1982.

    Dr. Ruck, Professor of Education at Southern Oregon State College, conducted this study to determine the effects of a systematic, individualized reading program utilizing the Guided or Controlled Reader on handicapped and nonhandicapped secondary school students who were reading from 1 to 3 levels below their grade placement. Sixty-seven students from grades 10 thru 12 participated in the project. Of these, 21 students were in the experimental group which used only the Guided or Controlled Reader for reading training. At the conclusion of the 10-week period of the project, a diagnostic reading post-test indicated that the experimental group showed an average gain in reading ability of one and fourth grades more than the control group and nearly one-half grade more than students who were in neither the control or experimental group.

27. Solan, Harold, A., (editor), "Visual Processing Training With the Tachistoscope: A Rationale and Grade One Norms," The Psychology of Learning and Reading Difficulties, New York: Simon and Schuster, Inc., 1973, p. 352-362.

28. Solan, Harold A. "The Improvement of Reading Efficiency: A Study of Sixty-three Achieving High School Students." Journal of the Reading Specialist 7; October 1967. Also EDL Research and Information Reprint No. 19. New York: EDL/McGraw-Hill, 1968. 6 pp.

    The rationale, equipment, materials, and procedures for a developmental reading program are presented. Data of sixty-three students, primarily from the tenth through twelfth grades, from six groups over a four-year period are included. Tables showing examples of the degree of improvement in perceptual efficiency and interpretive reading skills are presented.

29. Taylor, Earl A., Controlled Reading, Chicago: University of Chicago Press, 1937.

This study concludes that controlled reading training can be effective when teaching a student to read with speed and comprehension. The mechanical process should be controlled and developed simultaneously with the interpretative process. When comparing an experimental group, trained with the Metron-O-Scope, to a control group, the experimental group evidenced a more efficient method of attacking print as well as higher comprehension scores.

30. Taylor, Earl A. The Fundamental Reading Skill as Related to Eye-Movement Photography and Visual Anomalies. (Second Edition) Springfield, Illinois: Charles C. Thomas, 157pp.

The author points out the necessity for teaching the total process of reading: the interpretive skills as well as development of the fundamental reading skill. He explains how the usual procedures (used by teachers and specialists) and the use of educational instrument techniques can increase the reading and overall functional efficiency of the majority of pupils. Thirty-two case studies are included.

31. Traxler, Arthur E. "Value of Controlled Reading: Summary of Opinion and Research," Journal of Experimental Education, 11 (June, 1943), 280-92.

32. Urbancek, J. J., "The Speed-i-o-scope (Tachistoscope) Method for Teaching Mathematics," Visual Review, No. 50-2, Society for Visual Education, p. 1-3.

33. Waldstreicher, Joel S. "Educational Rehabilitation and Visual Education – An Integrated Approach." The Optical Journal and Review of Optometry, May 1, 1962. Also EDL Research and Information Reprint No. 12. New York: EDL/McGraw-Hill, 1968. 12 pp.

The author describes the procedures used at the Reading and Study Skills Center in New York City found to be effective for the individual with educational or vocational problems. The program of instruction is designed to re-educate the students with regard to their fundamental reading and learning skills; specifically, increased comprehension, better organization and more rapid interpretation of thoughts, improved directional attack, more orderly perception, heightened attention and concentration, more efficient binocular coordination and motility, and much greater skill and comfort in reading.

34. Warren, Mary Bay. "The Massapequa Junior High School Reading Program." Journal Of Developmental Reading 5:245-55; Summer 1962. Also EDL Research and Information Bulletin No. 14. New York: EDL/McGraw-Hill, 1968. 13 pp.

An experiment comparing the results of two reading programs – one machine oriented, the other using no mechanical devices – at Massapequa, New York, is described. In the pilot program two groups of twenty-five students of average ability were selected from two junior high schools. The Iowa Silent Reading Test, Form AM, and eye-movement photographs taken with the Reading Eye were used to check the subjects' reading skills. Both groups were then given a seven-week, twenty-one-session course including verbal and nonverbal perceptual training, vocabulary development., timed reading exercises with comprehension quizzes, and discussion of their reading.

The non-instrument group used only workbooks and regularly printed materials and received additional training in the SQ3R reading technique. The instrument group was trained with the EDL Controlled Reader. At the end of the training, Form B of the Iowa Test was administered and eye movements were rephoto-graphed.

Excellent gains were reported for both groups, but the instrument group achieved significantly higher gains in both reading rate and comprehension than the non-instrument group. A follow-up study incorporating the best features from both types of training into a longer, more thorough course is also described. Tables are included.

35. Witham, Anthony Patrick. An Investigation of a Controlled Reading Technique with Eighth Grade Students. (A Dissertation for Ed. D. Degree, Wayne State University, Detroit, Michigan, 1966.) ERIC Reading Review 7046; Supplement 1, 195 pp.

A comparison study over a ten-week training period involving two groups: 1) an instrument-oriented group utilizing the controlled reading program and 2) a material-oriented group. Post-study measurements indicated significant differences in favor of the instrument-oriented group in the following areas: speed and accuracy, vocabulary, fixations, regressions, and rate of reading. Significant differences also appeared in favor of the instrument-oriented group over the control group at a fourteen-week interval following the training pro-gram in all areas other than vocabulary and level of comprehension. A review of the reactions of teachers and students involved in this study is included.

36. Winger, F. E., "Tachistoscopic Training for Beginning Typewriting Instruction," Balance Sheet, 32, April, 1950, p. 342-347.

37. Winkleman, M. D., J. E., "Projection Tachistoscope for Orthoptic Treatments," American Journal of Ophthalmology, 33, 1950, p. 461-463.

38. Witzeman, B. Evangeline. "An Experimental Study Using the Opthalm-O-Graph and Metron-O-Scope in the Diagnosis and Treatment of Reading Defects." Journal Of Psychology 11:307-34: 1941.

This study set out to evaluate the Opthalm-O-Graph (a binocular eye-movement Camera) and the Metron-O-Scope (a device for providing controlled reading) as remedial reading instruments. The subjects were 400 high school students. In addition to standardized test measures, the Opthalm-O-Graph was used to take eye movement photographs of most of the subjects at the beginning and end of the experiments. The evidence after completion of the training indicated that use of the Metron-O-Scope provided significant improvement in rate and comprehension in the experimental groups over that achieved by the control groups.

There was also significant improvement in reading performance as reflected in a reduction in the number of fixations.

Pedagogical References

39. Allington, Richard L. "Fluency: The Neglected Reading Goal." The Reading Teacher. Vol. 36, No. 6, pp. 556-61, February1983.

40. Anderson, Irving H. "Studies in the eye Movements of Good and Poor Readers." Studies in Psychology of Reading, Volume 1. (Edited by Joseph Tiffin.) Psychological Monographs, Vol. 48, No. 3 (Whole No. 215). Princeton, NJ: Psychological Review Co., 1937. pp. 1-35.

41. Ballantine, Francis A. "Age Changes in Measures of Eye-Movements in Silent Reading." Studies in the Psychology of Reading. University of Michigan Monographs in Education, No. 4. Ann Arbor: University of Michigan Press, 1951. pp. 67-111.

This study summarizes eye-movement data secured from 120 pupils, ten boys and ten girls each in grades II, IV, VI, VIII, X, and XI, "to obtain growth curves for various eye-movement measures," "to

discover at what age growth for these measures levels off," and "to compare the growth curves for the easy and graded passages."

42. Betts, Emmett A., Foundations of Reading Instruction. New York: American Book Company, 1946.

43. Bond, Buy L., and Tinker, Miles A., Reading Difficulties, Their Diagnosis and Correction, New York: Appleton Century-Crofts, Inc., 1957, p. 270-271.

44. Brown, Don Arlen. The Effect of Selected Purposes on the Oculo-Motor Behavior and Comprehension of Third and Seventh Grade Students of Fifth Grade Reading Ability. (A Dissertation for Ed. D. Degree, University of Oregon, 1964) University Microfilms, Vol. 25, No. 10. Ann Arbor: Xerox Education Group. 5727.

    The effect of reading for different purposes on the oculo-motor behavior efficiency and comprehension of advanced third-grade readers and retarded seventh-grade readers was investigated. Tests administered to the students included the Gates Reading Survey and the Wechsler Intelligence Scale for Children. Experimental reading sets included were a set to read in the usual manner, a set to read to understand the main idea, and a set to read for detailed information. Performances in comprehension, reading rate, and relative reading efficiency interpreted by eye-movement photography were used in evaluating behavior. In noting the overall performance of both groups, the author stated that the advanced third-grade readers excelled significantly in reading rate and oculo-motor efficiency and that they read with significantly lower comprehension compared to the retarded seventh-grade readers. When directed to read in the usual manner, the retarded seventh graders read with the greatest efficiency and rate. When directed to read for the main idea, both groups had the highest comprehension, with the advanced third graders reading with the greatest efficiency and rate. When directed to read for detailed information, both groups read with the slowest rate and lowest relative reading efficiency.

45. Buswell, Guy T. Fundamental Reading Habits: A Study of Their Development. Supplementary educational Monographs, No. 21. Chicago: University of Chicago.

46. _____. How Adults Read. Supplementary Educational Monographs, No. 45. Chicago: University of Chicago Press, 1937. pp. 157.

A study was made of one thousand adults with varying amounts of education. The first purpose was to make individual analyses of the nature of the reading process in order to identify basic factors that differentiate poor readers from good readers. The second purpose was to carry on an experiment to discover how much these basic factors could be improved in a relatively brief period of time. The significant finding of the remedial experiment was that, in a limited amount of time, a gain in reading ability resulted from emphasis on four factors: 1) span of recognition, 2) regressive movements, 3) speed of perception, and 4) vocalization.

47. _____. "The Relationship Between Perceptual and Intellectual Process in Reading." California Journal of Educational Research 8:99-103; May 1957.

48. Carmichael, Leonard, and Walter F. Dearborn. Reading and Visual Fatigue. Boston: Houghton Mifflin Company, 1947. pp. 483.

    A six-hour experimental investigation demonstrated that visual fatigue in a student seemed to come from general attitudes and general feelings of the subject rather than from a breakdown of the sensory neuromuscular mechanism which performed the reading task. The most constructive aspect of this experiment was demonstrated when a motivational pattern of regularly interspersed tests of comprehension was employed. This pattern seemed to forestall the first phases of fatigue and enabled the student to maintain a high level of efficiency in reading for the six-hour period. Included are tables showing the summary of data according to eye-movement measures and comprehension scores. This volume, in addition to its reported study, is an excellent source of reference information on oculo-motor behavior.

49. Charlton, Bette. "Seeing is Believing." The reading Teacher 25:162-64; November 1971.

    The author advocates the reading Eye Camera as one of the most important supplemental diagnostic instruments for evaluation and motivation in reading. The use of the camera is recommended for detecting faulty visual functioning, determining specific types of corrective instruction, and for detecting nervous tension or physical discomfort during the reading act.

50. Dodge, Raymond. "Visual Perception During Eye Movement." Psychology Review 7:454-65; 1900.

51. _____. An Experimental Study of Visual Fixation. Psychological Review Monographs, Vol. 8, No. 4 (1907). Pp. 1-95.

The author reports on studies of 1) the causes of the specific character of visual fixations, 2) the adequacy of fixations, 3) the complication of vision during fixation, and 4) related problems.

52. Durrell, Donald D., Improving Reading Instruction, New York and Burlingame: Harcourt, Brace and World, Inc., 1956, p. 200-202.

53. Eames, T. H., "Visual Handicaps to Reading," Journal of Education, 141: 1-35, February, 1959.

54. Feinberg, Richard. "A Study of Some Aspects of Peripheral Visual Acuity." American Journal of Optometry and Archives of American Academy of Optometry 26:49-56, February; 105-19, March 1949.

This study shows the falloff of visual acuity away from a reader's point of fixation and illustrates the small amount of print seen clearly or with high resolution in a single fixation. This falloff of acuity explains, in part, why a reader's visual span of recognition is as limited as it is.

55. Flax, Nathan. "Visual function in Learning disabilities." Journal of Learning Disabilities, Vol. 1, No. 9 (September 1968). Pp. 74-79.

The function of the eyes and the necessary integration of a child's vision with his hearing, supported by touch and body movement, seems to be little understood by parents. Vision and visual perception are nearly always factors, both at home and in school, in evaluating and understanding a learning handicap.

56. Gates, Arthur I. "A Study of the Role of Visual Perception, Intelligence, and Certain Associative Processes in Reading and Spelling." Journal of Educational Psychology 17 (7): 433-45; October 1926.

In this study, about 310 first- through sixth-grade students were studied in an attempt to discover the correlations between achievement in reading and spelling, on one hand, and intelligence, perception, and capacity in associative learning, on the other. The results indicate that, of the abilities studied, the ability termed "word-perception: is most closely associated with achievement in reading and spelling; intelligence yielded the next highest correlation, while tests of perception of geometric figures of different sorts and digits, of associative learning of visual and

auditory symbols, or of visual and visual symbols show but slight association with these school abilities. A description of the specifically designed tests used in the study, as well as tables of the correlated findings, are included.

57. Gates, Arthur I., The Improvement of Reading, New York: Macmillan Company, 1935.

58. Geyer, John J. "A New Eye Movement Measure of Reading Efficiency." Reading: Process and Pedagogy. Nineteenth Yearbook of the National Reading Conference, Vol. 1. (Edited by George B. Schick and Merrill M. May.) Milwaukee: National Reading Conference, 1970. pp. 168-71.

    The author suggests that there is a central eye-movement measure around which other measures vary, vis., the coefficient of constancy of the temporal eye-voice span. The latter is obtained by measuring, for each fixation in a passage, the amount of time elapsing between the beginning of the fixation and the end of the voicing of the fixated word. The mean of these temporal eye-voice spans is divided by their standard deviation (C = M/O) yielding a number which is larger for longer, more constant spans. The author bases his theory on the premise that reading takes place across time through the semi-independent action of several processing and storage systems which can act simultaneously on different sequential segments of language. The author further states, "the consistency with which the temporal eye-voice span is maintained from fixation to fixation is closely related to the smoothness of the reading process.

59. Gilbert, Luther C. "Effect on Silent Reading of Attempting to Follow Oral Reading." Elementary School Journal 40:614-21; April 1940.

    The purpose of this study was to determine if listening to oral reading while attempting to follow the material silently is advantageous or detrimental to the formation of fundamental reading habits. Using elementary students from grades 2-6, the investigation indicated that 1) oral reading is a prerequisite to beginning silent reading, under ordinary classroom conditions, and 2) after the early adaptations have been made, listening to oral reading of sufficiently good quality may still have value in developing fundamental silent reading habits.

60. _____. Functional Motor Efficiency of the Eyes and Its Relation to Reading. University of California Publications in

Education, Vol. 11, No. 3. Berkeley: University of California Press, 1953. pp. 159-231.

This study compared students' skills in directing their eye-movements in a simple motor activity with the same ability displayed in the reading process. A substantial relationship was shown to exist. The study showed that control of the eye is not the pure product of experience in reading. A child is at his best to begin reading when his eyes move along lines from left to right and fixate accurately at critical points.

61. _____. "Saccadic Movements as a Factor inVisual Perception in Reading." Journal of Educational Psychology 50:15-19; February 1959.

This was a study to determine the relationship of the saccadic movements of the eyes to visual perception. The subjects included seventy-eight students at the college and graduate level from educational psychology classes. Short selections were projected, in word pairs. In one presentation, these word pairs were presented across the screen, requiring eye movement. In another form of presentation, the word pairs were presented centrally on the screen, consistently in the same position, requiring no eye-movement. The investigation revealed 1) good and poor readers make more perceptual errors reading with eye-movements than reading without eye-movements, 2) good and poor readers make fewer perceptual errors reading at 2/24-second level without saccadic movements than at 4/24-second level with saccadic movements, and 3) saccadic movements are associated with a substantially greater loss in visual perception for poor readers than good readers.

62. _____. "Speed of Processing Visual Stimuli and Its Relation to Reading." Journal of Educational Psychology 50:8-14; February 1959.

This was a study to determine a) the nature of individual differences in speed of processing visual stimuli and b) the relationship between the accuracy of perception and reading ability. The subjects included sixty-four students at the college and graduate level from educational psychology classes. From one to five word exposures were presented on a screen. Then, at varying intervals of time, interfering nonsense word-like material was presented. The investigation revealed that 1) interfering stimuli have a greater influence on the span of visual perception for the slow readers than for fast readers and 2) a substantial correlation exists between the length of the fixation pauses students use in reading simple prose

material and the speed with which the students can process tachistoscopically presented stimuli resulting from simple phrases.

63. _____. "Genetic Study of Eye-Movements in Reading." Elementary School Journal 49:328-35; March 1959.

This study compares the reading performance of students in the second grade with their reading performance as college juniors and seniors, in order to compare longitudinal change or growth in oculo-motor behavior. It is pointed out by the author that all the second-grade pupils made superfluous eye-movements when reading. He noted that their silent reading pattern was predominantly word by word, due, in part, to poor visual-functional efficiency. Significant changes were noted in the reduction of fixations and regressions of the subjects when tested later, a might be expected. There was a marked tendency, however, for those students who evidenced extremely long durations in second grade to continue to make comparatively long durations in college.

64. Gilbert, Luther C., and Doris W. Gilbert. "Reading Before the Eye-Movement Camera versus Reading Away from It." Elementary School Journal, 42 (1942), 443-47.

65. Harris, T.L. and Hodges, R.E. The Literacy Dictionary. Newark, DE: International Reading Association, 1995.

66. Johns, J.L. Informal Reading Inventories. DeKalb: Communitech International, Inc., 1993.

67. Jones, John Paul. Intersensory Transfer, Perceptual Shifting, Modal Preference, and Reading. Eric/Crier and the International Reading Association Reading Information Series: Where Do We Go? 1972. pp. 43.

This paper presents a critical review of research studies which explore various modal relationships – largely auditory versus visual. Included are recommendations for further research in three areas: intersensory transfer, intersensory perceptual shifting, and modal preference.

68. Koehler, Warren B. "Phrased Reading: Final Report." Independent School Bulletin 60-61, 14-18; 1960.

69. Kuhn, M. and Stahl, S. "Fluency – A Review of Developmental and Remedial Practices." Center for the Improvement of Early Reading Achievement Report, March 2000.

Comparison was made of both rate and comprehension a students read phrased (3-4 words) reading content vs. non-phrased. Both rate and comprehension significantly favored the reading of non-phrased content.

70. Laycock, Frank. "Significant Characteristics of College Students with Varying Flexibility in Reading Rate: I. Eye-Movements in Reading Prose; II. Motor and Perceptual Skill in 'Reading' Material Whose Meaning Is Unimportant." Journal of Experimental Education 23: 311-30; June 1955.

    Part I of this report describes a study in which the eye-movements of "flexible" and "inflexible" readers were photographed in order to probe the subjects' eye-movement characteristics as they tried to read faster. The findings indicate that ease in controlling eye-movements is a factor in achieving flexibility. Part II describes another study involving the same "flexible" and "inflexible" readers in "quasi-reading" situations which minimized the importance of content. The purpose was to test the efficiency of eye-movement. The findings indicate that students who increase speed easily seem to have visual and perceptual advantages which aid them. The author further states, "From the broad view, these findings show that reading flexibility is associated with factors that can be detected by eye-movement camera, tachistoscope, and measures of discrimination."

71. LeBerge, David, and S. Jay Samuels. "Toward a Theory of Automatic Information Processing in Reading." Cognitive Psychology, Vol. 6, No. 2 (1974), pp. 293-323.

72. McConkie, George W., and Thomas W. Hogaboam. "Eye Position and Word Identification During Reading." Technical Report No. 33, Center for the Study of Reading, University of Illinois at Urbana-Champaign, April 1985. 31pp.

    College students read text displayed by computer as their eyes were being monitored. On occasional fixations or saccades the text was removed and the subject reported the last word that had been read and tried to guess the next word. Distributions of the location of the last read word with respect to the last fixated word give an indication of what words are being read during a fixation. The data do not support an anticipation model of reading nor the acquisition of peripheral cues concerning upcoming words.

73. McConkie, George W., and Keith Rayner. "Asymmetry of the Perceptual Span in Reading." Bulletin of the Psychonomic Society. Vol. 8, No. 5 (1976). Pp. 365-368.

As on-line computer technique was used to determine whether three skilled readers acquired visual information equally far to the left and right of central vision during fixations in reading. None of the subjects appears to use visual information more than four characters to the left of the fixation point (smaller distances were not tested), though all of them acquired visual information substantially further than that to the right. Thus, the region of useful information in reading is asymmetric around the fixation point.

74. McConkie, George W., and David Zola. "Eye Movement Control During Reading: The Effect of Word Units." Technical Report No. 310, Center for the Study of Reading, University of Illinois at Urbana-Champaign, March 1984. 21 pp.

This paper deals with the control of forward saccadic eye-movements in reading. Analyses of a set of eye-movement data that deals with the interplay between eye guidance and word pattern information are described. The conclusion is that the likelihood of forward saccades taking the eyes to a particular letter position is a function not only of the distance of that position from the prior fixation, but also of the word length and the letter position in the word which that position occupies. An hypothesis is advanced which suggests that, in reading, the eyes are simply sent to the next unidentified word with location preferences in the word being a complex function of length and distance.

75. McConkie, George W., David Zola, Harry E. Blanchard, and Gary S. Wolverton. "Perceiving Words During Reading: Lack of Facilitation From Prior Peripheral Exposure." Technical Report No. 243, Center for the Study of Reading, University of Illinois at Urbana-Champaign, May 1982. 56 pp.

College students read short tests displayed on a cathode-ray tube as their eye-movements were being monitored. As they read, the contents of certain word locations changed from fixation to fixation, alternating between two words differing in two letters. This manipulation had no effect on reading unless the subjects happened to regress to or reread the word later. The results indicated that these words, which were low in contextual constraint, were read only when directly fixated, and that there was no facilitation from proper peripherally obtained information about the words.

76. Morse, William C. "A Comparison of the Eye-Movement of Average Fifth and Seventh Grade Pupils Reading Materials of Corresponding Difficulty." Studies in the Psychology of Reading. (William C. Morse, Francis A. Ballantine, and W. Robert Dixon) University of Michigan Monographs in Education, No. 4. Ann Arbor: University of Michigan Press, 1951. pp. 1-64.

This paper reports the procedures and findings of a carefully planned laboratory study involving fifty-four pupils each in grades five and six to test the hypothesis that, "If material could be found for the poor reader which is just as easy for him as more difficult material is for the good reader, the eye-movements of the two might then be the same." Contrary to expectations, the fifth grade pupils did not perform as efficiently as the seventh grade pupils when the materials were differentiated according to reading status of the subjects. Also contrary to expectations, it was not found that eye-movements change in any predictable way with increase in the difficulty of the material, reflecting the relatively habitual nature of the oculo-motor activity.

77. Morse, William C., Francis A. Ballantine, and W. Robert Dixon. Studies in the Psychology of Reading. University of Michigan Monographs in education, No. 4. Ann Arbor: University of Michigan Press, 1951. 188 pp.

This study includes three condensed reports of doctoral dissertations prepared at the University of Michigan relating to the a) eye-movements of fifth and seventh grade pupils when reading materials of corresponding difficulty (Morse); b) age changes in measures of eye-movements in silent reading (Ballantine); and c) eye-movements in reading of university professors and graduate students (Dixon).

78. National Reading Panel. "Teaching Children to Read: An Evidence-Based Assessment of the Scientific Research Literature on Reading and its Implications for Reading Instruction." Report of the Sub-Groups. April 2000.

79. Neil, V. Lost in a Book: The Psychology of Reading for Pleasure. New Haven: Yale University Press, 1988.

80. Norman, D. A., and D.G. Bobrow. "On data-limited and resource-limited processes." Cognitive Psychology, 1975, 7, pp.46-64.

81. Pinnell, G.S., Pilulski, J.J., Wixson, K.K., Campbell, J.R., Gough, P.B. and Beatty, A.S. "Listening to Children Read Aloud."

Washington D.C.: Office of Educational Research and Improvement, U.S. Department of Education.

82. Pollack, M. F. W., and Piekarz, Josephine A., Reading Problems and Problem Readers, New York: David McKay Co., 1963, p. 215-216.

83. Rayner, K. "Eye movements, perceptual span, and reading disability." Annals of Dyslexia, 33:163-73; 1983.

84. _____. "The role of eye movements in learning to read and reading disability." Remedial and Special Education. 6:53-60; Nov./Dec. 1985.

85. Reutzel, D.R. and Hollingsworth, P.M. "Efforts of Fluency Training on Second Graders' Reading Comprehension." Journal of Educational Research., Vol. 86 (1993): 325-331.

86. Robinson, Francis P. "The Tachistpscope as a Measure of Reading Perception." American Journal of Psychology. 46:132-135.

The purpose of this study was to evaluate the tachistoscope as a measure of reading span. Using an alteration of the tachistoscopic procedure into one more closely approximating the reading situation, the author photographed the eye movements of 51 college students as they read a given selection. These students were then tested tachistoscopically to determine span during flashed exposures. Comparisons of average span in reading with span of perception during conventional tachistoscopic exposures showed the span utilized during reading to be less than half that during tachistoscopic exposures. The author attributed the difference in part to the interval of time between tachistoscopic exposures as contrasted with that of reading. The author concluded that the tachistoscope could not properly be used to measure span in reading and that it was not probable that even better readers with training would find it possible to attain reading spans equivalent to those achieved tachistoscop-ically.

87. Ruck, William E. "A Program to Improve Reading Skills of Mainstreaming Students at the Secondary Level." A research study conducted at the School of Education/Psychology, Southern Oregon State College, February-May 1982.

Dr. Ruck, Professor of Education at Southern Oregon State College, conducted this study to determine the effects of a systematic, individualized reading program utilizing the Guided of Controlled Reading on handicapped and non-handicapped secondary school

students who were reading from 1 to 3 levels below their grade placement. Sixty-seven students from grades 10 through 12 participated in the project. Of these, 21 students were in the experimental group which used only the Guided or Controlled Reader for reading training. At the conclusion of the 10 week period of the project, a diagnostic reading posttest indicated that the experimental group showed an average gain in reading ability of one and one-fourth grades more than the control group and nearly one-half grade more than students who were in neither the control nor the experimental.

88. Sherman, Hoyt L., Drawing by Seeing, New York: Kinds, Hayden and Eldredge, 1947, pp. ix + 77.

89. Smith, Karl U., Robert Schremser, and Vernon Puts. "Binocular Coordination in Reading." Journal of Applied Psychology. Vol. 55, No. 3. 1971, pp. 251-258.

90. Snow, C.E., Burns, S.M. and Griffin, P. "Preventing reading difficulties in young children." Washington, D.C.: National Academy Press, 1998.

91. Solan, Harold. "Visual Processing Training with the Tachistoscope: A Rationale and Grade One Norms." Journal of Learning Disabilities. 2 (1)"32-38; January 1969.

    This paper provides a rationale for the inclusion of visual processing training with a tachistoscope in a reading instruction program. It also establishes a set of expected tachistoscopic responses using three digits at 0.1 and 0.01 seconds for children in the sixth month of grade one whose average age is six years, five months. Using a sample of 250 children, the mean, the median scores, and a percentile scale were developed so that a child in grades one, two or three who is experiencing a perceptual deficit can be compared to the grade one child. The coefficient of correlations between success in reading and tachistoscopic response at each speed was calculated and is included. The author states, The tachistoscopic exposure test using three digits at 0.1 and 0.01 seconds distinguished those youngsters whose visual sensory maturation is lagging.

92. _____. "Deficient eye-movement patterns in achieving high school students: three case histories." Journal of Learning Disabilities. 18:66-70.

93. _____. "Near Point Diagnosis and Visual Training with the Prism Reader." American Journal of Optometry and Archives of

American Academy of Optometry Monograph No. 238, October 1958.

This paper outlines the dynamic performance tests and correctional procedures that are made possible with the Prism Reader, thus enabling diagnosis and treatment of functional deficiencies.

94. Solan, Harold., Jerome Feldman and Laura Tujak. "Developing Visual and Reading Efficiency in Older Adults," Optometry and Vision Science: Vol. 72, No. 2, pp. 139-145, 1995.

This study involved twenty subjects, ages 62 to 75 from the New York Metropolitan area who had corrective Snellen visual acuity of at least 20-30 with no known oculo-motor anomalies. Eye-movement recordings were taken before and after a program of reading efficiency development. Subjects were assigned to either a control/training or training group. Twenty training sessions involving Taylor Associates' PAVE: Perceptual Accuracy/Visual Efficiency and Guided Reading programs as well as tachistoscopic training and React training were provided. The training group was given such reading efficiency training for eight weeks (16 sessions) and then were tested again. The control/training group was tested after eight weeks and then some members received similar reading efficiency training for eight weeks beyond the control period and were tested again. Results revealed a statistically significant and clinically meaningful improvement of all aspects of reading efficiency for all members who received such reading efficiency training. The recommendation in this report was that reading efficiency training be stressed to a greater extent at all age levels.

95. Spache, George D., "Evaluation of Eye-Movement Photography in Reading Diagnosis and Reading Training." Research and Evaluation in College Reading. Ninth Yearbook of the National Reading Conference for College and Adult. (Edited by Emery P. Bliesmer and Oscar S. Causey.) Fort Worth: Texas Christian University Press, 1960. Also EDL Research and Information Reprint No. 5. New York: EDL/McGraw-Hill, 1962. 11pp.

This paper discussed the four basic purposes for recording eye movements as part of a reading diagnosis, 1) to survey the individual's mechanical functioning in the reading act, 2) to obtain indications of the need for specific types of corrective instruction, 3) to give indications of visual-functional difficulty, and 4) to observe the reader's general adjustment to a reading situation.

96. Stanovich, Keith E. “Toward an interactive-compensatory model of individual differences in the development of reading fluency.” Reading Research Quarterly. Vol. XVI, No. 1 (November 1980), pp. 32-71

A review of the research literature seems to indicate that, beyond the initial stages of reading acquisition, superior reading ability is not associated with a greater tendency to use the redundancy inherent in natural language to speed word recognition. Instead, general comprehension strategies and rapid context-free word recognition appear to be the processes that most clearly distinguish good from poor readers.

97. Storm, Grace E., and Smith, Nila B., Reading Activities in the Primary Grades, Boston: Ginn and Company, 1930.

98. Taylor, Earl A. “The Spans: Perception, Apprehension, and Recognition.” American Journal of Opthalmology. 44:501-07; October, 1957. Also EDL Research and Information Reprint No. 1 New York: EDL/McGraw-Hill, 1968. 9 pp.

Some history relating to the study of eye movements is reviewed. The various “spans,” the span of perception, the span of apprehension, and the span of recognition are described and a chart is presented to show the average span of recognition at various grade levels. It is shown that the average reader cannot see either several words or a phrase at a single fixation. The author points out that a reader must not only be able to read rapidly, but must also be able to function well enough to read for long periods of time without discomfort and tension. The author also states that accuracy and precision must be key considerations in any reading instructional program.

99. Taylor, Earl A., Controlled Reading: A Correlation of Diagnostic, Teaching and Corrective Techniques, Chicago: University of Chicago Press, 1937.

100. Taylor, Earl A., and Solan, Harold A., Functional Readiness and School Adjustment, New York: Reading and Study Skills Center, 1956.

101. Taylor, S. E., National Study of Fluency in the Primary Grades, Phase II Final Report - School Years 1978-81, Monograph No. 11, Huntington, New York: Instructional/Communication Technology, Inc., 1981, pp. 29.

102. Taylor, S,E., and Frackenpohl, H., Controlled Reading, Huntington, New York: Educational Development Laboratories/McGraw-Hill Book Company, 1956, 1968, 1970 p. iv-153.

103. Taylor S. E., and Frackenpohl, H., Tachistoscopic Techniques, Huntington, New York: Educational Development Laboratories/ McGraw-Hill Book Company, 1956, 1968, 1970, p. v-82.

104. Taylor, S.E., Heflin, V.B., and White, C. E., Teacher's Guide for Guided Reading, Huntington, New York: Instructional/ Communications Technology, Inc., 1974, pp. 39.

105. Taylor, S.E. Eye-Movement Photography with the Reading Eye. New York: EDL?McGraw-Hill, 1060.

106. _____. "Reading Instrument Usage." The Reading Teacher 15:449-54; May 1962.

This pamphlet discusses various kinds of equipment currently in use in schools for reading improvement and points out that these are to be used as aids to the teacher and as part of a total reading program.

107. _____. "Sensation and Perception." Journal of Developmental Reading. 6, Spring 1963. Also EDL Research and Information Brief No. 6, New York: EDL/Mc-Graw-Hill.

108. _____. Listening. "What Research Says Series." No. 29. Washington: National Education Association of the United States, April1964.

109. _____. "Eye-Movements in Reading: Facts and Fallacies." American Educational Research Journal 2 (4); November 1965. Also EDL Research and Information Reprint No. 18. New York: EDL McGraw-Hill, 1967.

110. _____. "Dynamic Activity of Reading." EDL Research and Information Bulletin, Bulletin #9. New York: EDL/McGraw-Hill, 1971.

111. _____. "Fluency in the Primary Grades." From a speech entitled, "Meeting the Needs of Beginning Readers" given at the International Reading Association 1975 Annual Convention. I/CT Teacher Education Reprint No. 3, Huntington, NY, 1976.

112. _____. “Visual Activity of Reading.” I/CT Teacher Education Script booklet 4. Huntington, NY: Instructional/Communication Technology, 1976.

113. Taylor, Stanford E., and Helen Frackenpohl. “Timex and Controlled Reader Teach Fundamental Learning Skills,” Audio-Visual Guide, 21 (May 1955).

114. Thompson, Warren C. “A Book-Centered Course Versus a Machine-Centered Course in Adult Reading Improvement, “Journal of Educational Research, 49 (February, 1956), 437-45.

115. Traxler, Arthur E. “The Relation Between Rate of Reading and Speed of Association,” Journal of Educational Psychology, 25 (may 1935).

116. Walker, R.Y. “The eye-movements of good readers: Studies in experimental and theoretical psychology.” University of Iowa Studies in Psychology, No 17, Psychological Monographs, 44, No. 3, 1033.

117. West, Richard F. Efficient Processing Activities in Reading. Newark, DE: The International Reading Association, 1978.

118. Underwood, W.R. and George McConkie. “Perceptual Span for Letter Distinctions During Reading.” Technical Report No. 272, Center for the study of Reading, University of Illinois at Urbana-Champaign, April 1983.

This study investigated the size of the visual region within which adults use visual information to distinguish among letters as they read. Fifteen college students read passages from a cathode-ray tube as their eye-movements were monitored. On occasional fixations, letters in specified regions were replaced by other letters. The effects of this manipulation were observed on their eye-movement patterns. Erroneous letters lying four or more letter positions to the left of the fixated letter, or eight or more to the right, had no discernible effect on reading.

D. Contextual Analysis/Vocabulary Input

Along with fluency in reading, students need to become skilled in careful analytical reading in programs that stress contextual analysis to derive meaning and understanding and the meaning and functions of vocabulary. These contextual analysis programs provide structured guidance and reinforcement for these essential study/reading proficiencies.

1. CLOZE-PLUS (Levels 1 – 8)

Goals of the CLOZE-PLUS Program

The 8 available levels of the CLOZE-PLUS program contain 20 reading selections per level. All selections are written with vocabulary that is appropriate for the designated reading level, and all information needed to complete an activity is contained in the text. Therefore, a lack of proper knowledge or experiential background is not a factor that will inhibit comprehension. Levels 1 and 2 are based on the Spache Readability Formula, and Levels 3 – 8 on the Frye Readability Formula. The selections within each level are arranged in ascending order of readability difficulty.

Each lesson consists of four to sixteen paragraphs on a particular topic. A wide variety of interesting subject matter (natural science, inventions, historical events, archaeology, myths and legends, etc.) has been included to provide factual information.

CLOZE-PLUS is a computer based reading improvement program designed to develop comprehension and vocabulary knowledge and use through structured context analysis activities. The program is designed to develop a student's ability to integrate meaning across sentences, the ability to understand an extended passage, literal and inferential comprehension skills, the ability to use a variety of contextual analysis strategies, predictive abilities, and test-taking techniques. It involves a dual approach that combines structured cloze instruction with vocabulary-in-context activities. The structured cloze activities require the student to use context to complete syntax, and to demonstrate comprehension. The vocabulary-in-context activities require the student to derive the meaning of difficult or unfamiliar words by analyzing the information in the surrounding context.

Structured Cloze

Structured cloze consists of expository reading material, which includes selective deletions. Each paragraph in a selection is constructed to emphasize one idea and usually contains only one deletion. The paragraph is constructed to contain syntactic and semantic clues that lead to replacement of the deleted word. These clues may appear in sentences that come before, after, or both before and after the sentence with the deletion.

When the deletion is accompanied by a multiple choice activity, all choices are syntactically and semantically appropriate in the sentence containing the deletion. However, only one choice is appropriate in the context of the entire paragraph in which the deletion sentence occurs; thus, the student is required to integrate meaning from a number of sentences in order to select the appropriate missing word. Further, all word choices consist of familiar words, in order to eliminate the possibility that the student might understand the passage but make an incorrect choice because of unfamiliarity with the words used as choices.

When the deletion is not accompanied by a multiple choice response and the student is required to generate a word to complete meaning and syntax, the missing word is predictable and, likewise, must be derived from the information in a number of sentences. Since several words might be appropriate, considering the redundancy of language, provision is made for a variety of correct responses. Following the entry of a correct word the student is shown a list of other words that he/she might have used.

Vocabulary in Context

In the vocabulary contextual analysis portion of CLOZE four major avenues of analysis are employed to develop sensitivity to the role that context plays in the determination of meaning. They include synonyms, or substituting a known word with a similar one; definition, or deriving the meaning of a word from words or phrases in a paragraph; comparing and contrasting, or determining like and unlike words; and interpretation/ application, or applying words in a different situation and extending their usage.

Cloze Plus Lessons

There are three major types of completion activities used in CLOZE-PLUS:

- Meaning Completion Cloze in which the student reads a paragraph in which a word is missing. He/she will then select the correct word from 4 choices, with only one being the correct answer.

- Syntax Completion Cloze involves a student reading a paragraph with a missing word. The student will then be asked to type in the omitted word. Two to four different appropriate words may be used, and the student is correct if he/she selects any one of the appropriate words.

- Vocabulary in Context involves the student selecting the meaning of a "difficult" or unfamiliar word by using the context clues in the sentences surrounding the word.

The appropriate level in which a student is placed will be determined by the Reading Plus CPA Vocabulary assigned level or a teacher assigned level. Entry-level content is typically 1-2 levels above IRL. Each lesson will require, on average, 10-15 minutes to complete. Once the appropriate level is determined, a student will choose the selection he/she wishes to use. Students who are on levels 1 or 2 will be presented with up to 6 key over-grade or topical words in a lesson. Each of these less familiar key words will be presented in a context sentence from which the target word has been omitted. The target word is then "flashed" briefly in the blank in the context sentence and then disappears. The student will then type the target word. If he/she should make more than one typing error, the correct letter will automatically appear and the student will continue typing until the word is completed.

Next, the student will read the selection, paragraph by paragraph, and complete cloze or vocabulary meaning activities after each paragraph. Before responding to each activity question, the student may receive assistance by clicking on the Clues button, which presents key relevant information in an underlined fashion. If the student responds correctly on the first try, he/she will receive a congratulatory message and then move on to the next exercise. If the student responds incorrectly on the first response, he/she has the option of requesting clues before his/her next response. If he/she answers incorrectly on the second try, he/she is scored incorrect and the correct answer is automatically supplied.

At the end of the lesson a student is supplied with a report screen that includes the lesson number, percentage score, and number of extra tries. A student's performance on the preceding 5 lessons is also displayed to encourage growth and application.

In the CLOZE-PLUS program, a number of contextual analysis skills are given specific attention. They are:

- Same Meaning/Synonyms – words or phrases that are synonymous with the correct choice.

- Opposite Meaning/Antonym – words or phrases, which are antonymous to the correct choice.

- Association/Synthesis – words or phrases, which lead to the correct choice because of their relationship to it.

- Categorization/Classification – words or ideas that logically fall into the same grouping as the correct choice.

- Time/Order – words which indicate the sequence in which ideas are presented.

- Signal Words, Phrases/Transitions – words and phrases, which signal presentation of contrasting, additional, similar, information, etc.

- Pronoun Referents – pronouns, which are used interchangeably with critical nouns in the passage.

- Similarities/Differences – words or phrases that present analogous or differentiating ideas.

- Form/Function – words which have widely differing meanings or which serve a specific function in the paragraph. (This skill is not employed in Levels A and B.)

- Conclusion/Summary – words or phrases which lead the reader to draw a conclusion or to summarize.

- Definition – word meaning derived from words or phrases in the paragraph which reveals the meaning of the word.

At the end of each CLOZE-PLUS lesson, the student is also given a listing of the eleven skills and a tabulation of his/her correct and incorrect responses.

History and Pedagogical Background

CLOZE-PLUS was designed by Stanford E. Taylor and authored by Edith Goldstein and Clair Chalmers in the 1980's. This software program evolved from a series of CLOZE Power books (8) also designed by the authors in the 1970s.

The term "cloze" was first used by Wilson Taylor in 1953 (17) and is derived from the concept of closure, "clozure" developed in Gestalt

psychology. It refers to the tendency of an individual to mentally complete or make whole an incomplete pattern and to see a complete pattern more rapidly than an incomplete one.

CLOZE Studies

Over the years, there has been extensive research done using the cloze procedure, and many studies document its effectiveness in enhancing reading comprehension and reading ability.

A study conducted by William H. Weldon (25) on the use of the cloze procedure as an instructional tool in a middle school classroom concluded that increased student learning occurred as a result of the use of cloze sheets. The treatment group which received cloze instruction produced a mean score of four percentage points above the mean score of the control group on a teacher-made multiple choice test. The teacher concluded that the cloze procedure has the potential to help average and below average students enhance their learning. The treatment group had a median grade of B, while the control group had a median grade of slightly above a D.

A study was conducted by Carol Kelty in 1999 (15) in which questioning techniques and the cloze procedure were used to increase reading comprehension of second grade students. Results of the study indicated that 20 out of 24 students improved their accuracy of replacement words on a cloze test by at least 20%. Furthermore, 19 out of 24 students improved their score on a comprehension test by at least 15%.

Other studies on the cloze procedure have been conducted by Hays(13), Gauthier(8) and Andrews (1) who found cloze procedures effective in helping students make connections with concepts contained in content material. Fuchs (7) found cloze procedures to be effective with special education students. Santa (21) found that cloze sheets provide opportunities for recall and contribute to better conceptual organization of information.

Dwyer (4) contended that the use of the cloze procedure, frequently with modifications, can provide reading teachers with an interesting and instructionally sound approach for supplementing the basic reading program. His study suggests that the cloze procedure can be used for teaching students how to read more competently as well as a means of evaluating their reading achievement.

Pessah (18) 1975 conducted a study to ascertain the effectiveness of the cloze procedure when used as part of the remedial instruction in community college classes. The study noted that the students' score on

the Nelson-Denny Reading Test improved significantly when the cloze procedure was utilized.

Kennedy (16) 1971 conducted a study to determine if visual training with the cloze procedure would improve listening and/or reading comprehension. Results showed that the experimental reading group that received training visually with the cloze procedure did significantly better on the Durrell Listening Reading (DLR) series reading comprehension test than did the control groups, and an experimental listening group, which received training auditorially with the cloze procedure.

Peters (20) 1983 conducted a study to determine if instruction in the cloze procedure could affect standardized reading comprehension test scores. All subjects were given the Gates MacGinitie Reading Test as a pretest to determine their level of reading comprehension. Subjects in an experimental group received classroom instruction in addition to instruction with cloze exercises. The control group received just classroom instruction. All students were retested at the end of the experimental period with the Gates-MacGinitie test. The results indicated a pronounced reading comprehension gain for the experimental group.

Gunn and Elkins (12), 1976 discussed the relationship between cloze demands and reading comprehension and describes a cloze program used in a third-grade classroom. The study noted that the cloze program was effective in raising comprehension skills (measured by standardized tests) after both an initial and subsequent period of eight weeks.

Jongsma (14) 1980 in his review of earlier studies conducted on the cloze procedure concluded, "It appears that selective deletion systems aimed at particularly contextual relationships are more effective instructionally than semi-random deletion systems such as every nth word or every nth noun-verb. Of course, theoretically, cloze has been built on the notion of semi-randomness and this notion has held up well, particularly in readability research. However, for instructional purposes, selective deletion systems seem to be more effective."

In addition to a teaching method, it should be noted that the structured cloze method is also being utilized as a testing method. The DRP (Degrees of Reading Power) developed by Touchstone Applied Science Associates (TASA) and the New York State Department of Education in 1977(3) is a comprehension test, which employs the structured cloze format. According to TASA management, over 4,000,000 DRP tests were administered in states, school districts, and college and university testing programs. According to company sources the DRP test is administered in almost every state. TASA also provides what is known as "secure" tests that are composed of text and test items that have never been administered

and are typically used only in one test administration as a secure test. States that use the secure DRP are Connecticut, New York, and Virginia.

Fitzgerald (6) 1980 examined the diagnostic potential of a structured cloze test used in the reading measurement of the New York state Regents Competency Exam. Two passages at the third and fifth grade levels were administered to low achieving fifth grade students: first, in a standardized cloze format requiring the students to generate responses; and next, in a structured cloze format requiring the recognition of the correct response. Results indicated that both recognition tasks produced higher mean scores than the generation tasks.

Vocabulary Studies

Context analysis has long been recognized as one of the more effective means of developing vocabulary, and structured content is likewise particularly appropriate for developing the strategies involved in the process of context analysis. When a reader is led to the meaning of an unknown word by examining it in the framework of structured context, which contains clues to its meaning, he or she is more likely to make that word a permanent part of his or her vocabulary because the logical process of inferring the meaning has been followed.

Contextual analysis has been widely analyzed as an effective tool in enhancing vocabulary skills. Greenwald (11), 1979 listed contextual analysis as a technique that can be used to increase a student's recognition vocabulary for a second language. Standal, and Schafer (23), 1978 listed contextual analysis as a strategy that promotes an effective vocabulary program. Clayton (2), 1970 suggested that among the skills that should continue to be developed beyond primary grades include vocabulary and concept development. She said an emphasis should be placed on contextual analysis. Nourie and Davidson (18), 1992 suggested that the most powerful vocabulary learning technique involves a combination of contextual analysis along with structural analysis.

Farstrup and Samuels (5) 2002, in *What Research Has to Say About Reading Instruction*, state that carefully planned and robust instruction using context clues should be part of a comprehensive vocabulary program. They site Graves (10) 2000, Stahl (22) 1998, and Sternberg (24) 1987, as stating that the use of context is the most widely recommended and most useful strategy to help students increase their vocabularies.

Current Research

In addition, Taylor Associates has received a number of research reports from schools that have utilized CLOZE-PLUS as a part of the Reading

Plus system usage. These briefs may be viewed in the research section of the Taylor Associates website www.ta-comm.com.

Brief #21
Impact of Taylor Associates' Reading programs on Reading Efficiency (Visagraph) and Reading Comprehension (Gates-MacGinitie Standardized Test)
A study conducted by Dr. Harold Solan of the SUNY College of Optometry involving Taylor Associates' Reading Plus programs (Comprehension Power, CLOZE-PLUS, Guided Reading and PAVE: Perceptual Accuracy/Visual Efficiency). Nine 6th graders who scored low on the Gates-Macginitie. Five of the subjects received 12 one-hour sessions using Taylor Associates' Comprehension Power and CLOZE-PLUS programs followed by 12 one-hour sessions using Guided Reading and PAVE: Perceptual Accuracy/Visual Effectiveness. The other four received the training in reverse order. Overall, the subjects Gates-MacGinitie mean reading score improved by 2.4 grades in just 0.7 years. Before training, the subjects' mean Gates MacGinitie score improved only 3.1 grades over 5.1 years.

Brief #38
Beebe Elementary School, AR
A controlled study of 11 second graders and 14 third graders. Those in the experimental group received three sessions of Guided Reading and PAVE a week plus one session per week of CLOZE-PLUS and Comprehension Power on the alternate days. The Grade 2 experimental group's average score on the Stanford 9 standardized test improved by an average of 5.7, while the control group's fell by an average of 4.7, a difference of +10.4. The difference between the third grade experimental and control groups mean Stanford 9 gains was +10.2

Brief #45
Talihina Junior High School, OK
Remedial students at Talihina Junior High School in Talihina, Oklahoma received instruction three times per week with Taylor Associates' Comprehension Power, CLOZE-PLUS, and Reading Around Words. Students also received limited training with Guided Reading and PAVE. The average ITBS gain for students who received training with Talor Associates programs was 1.6 grade levels. Prior to receiving instruction with Taylor Associates programs, the students' average yearly ITBS gain in grade level was 0.7.

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2. Reading Around Words (Levels 4-12)

Reading Around Words is available in Sets D-L (Levels 4-12). Each level contains a pre-test, a posttest, and 240 word lessons.

Goals of the Reading Around Words Program

The goal of the Reading Around Words program is to expand word knowledge through structured contextual analysis strategies employed in over 2,000 vocabulary lessons. Spelling competence is developed in conjunction with word knowledge as students proceed through contextual exercises treating 4 major contextual analysis skills:

- Synonyms /Antonyms
- Choose definitions / Select usage
- Compare / Contrast
- Interpret / Apply

The most challenging and difficult of these skills involves interpretation of meaning and use, so this skill is treated most intensively at all levels.

Nature of Reading Around Words Lessons

The vocabulary lessons can be approached in two ways: either all words on a given level may be studied, or a pretest may be used to eliminate previously mastered words.

If students elect to take the pre/posttest, they will be given a preliminary appraisal on each group of 60 target words on a level. The number of incorrect responses (in meaning or usage) will indicate the words that need to be studied, and appropriate lessons using these words will be presented. To eliminate the tendency to guess on the pretest, "Not sure" is offered as an acceptable response. These words will be included in the lessons presented. (When vocabulary lessons have been completed, a posttest will measure vocabulary mastery.)

If students choose not to take the pretest, 60 word lessons will be provided. There are four 60-word groupings for a total of 240 words per level.

A student is initially presented with a context sentence using one of the lesson words. The target word is omitted, and the student is directed to flash the missing word and type it in. A paragraph including the target word and contextual information appears, and the student is directed to read the paragraph carefully.

Following the paragraph, a multiple-choice word meaning or use exercise is presented. The student may immediately complete the exercise, or return to the paragraph. He/she may switch from the quiz to the paragraph as many times as desired. Help in the form of underlined key words is available.

If an incorrect entry is made, the paragraph will be displayed with the clues underlined and directions to study the clues, and then return to the quiz. If the second response is also incorrect, an explanation of the use of the context clues is provided. When the student has read the explanation, he/she returns to the quiz. The student is always required to click on the correct response.

Finally, for spelling practice, the context sentence with the target word omitted is presented. The word is flashed (1/10 of a second exposure), and the word is then typed from memory. If any letter is typed incorrectly, it will not appear on the screen; the correct spelling will appear briefly below. If a second error is made, the entire word appears, and the student will move on to the next lesson.

When the student has completed the lessons for all words missed on the pretest, a posttest is given. The entries on the posttest are the same as those appearing on the pretest. If the student has not demonstrated mastery of certain words, they are displayed at the end of the posttest for recommended study.

Records of words studied and mastered are available to the teacher through Management in displayed or printed form.

Usage Considerations

The vocabulary treated in the Reading Around Words lessons was derived in part from the reading selections in Taylor Associates' Guided Reading and Comprehension Power programs, levels 4-12. It also reflects consideration of the vocabulary listings in EDL's Core Vocabulary levels 4-12.

Students should be placed in the Reading Around Words program at a level which will provide both challenge and success. In most cases, the appropriate working level will be one that is on or slightly above the student's independent reading level. When students are placed appropriately, they will have little difficulty with the concepts or the vocabulary in the context that surrounds the above-level target words or with the accompanying quizzes.

There are several methods of determining an appropriate entry level:

- Computerized Placement Appraisal – Taylor Associates' CPA: Computerized Placement Appraisal can be used to place students. This appraisal requires approximately 20-30 minutes. In addition to a final vocabulary level (indicating Reading Around Words placement), CPA also provides insights as to independent reading level, reading rate(s) and comprehension competency.

- Teacher Judgment – Many teachers, especially in the upper elementary grades, will know their students' capabilities and they can easily decide which vocabulary study level is most appropriate for each student. For instance, if a fifth-grade teacher knows that a student is reading independently at Level 5, he/she can assume that Reading Around Words Levels 6 or 7 will be generally appropriate for the student.

- Standardized Test Scores – When using a standardized reading test score as the basis for placement in the Reading Around Words program, it is generally recommended that students be placed one level below their test scores, since test scores usually represent a frustration level. If a student's standardized reading test level is 7.2, the student should begin Reading Around Words on level 6, which is most likely the student's instructional level.

Once a student has been assigned an entry level by one of the above methods, it is possible to make further evaluation of appropriateness. Since most students will take the Reading Around Words pretest, performance on each 60 word pretest may be evaluated on the following basis:

> Twelve to twenty-four errors or "not sures" in a group of 60 words on a level indicates that the student is likely placed appropriately and should proceed with this level. Twenty-five or more errors or "not sures" would suggest that the teacher should reassign the student to the next lower level.

The Pedagogy and History of the Reading Around Words Program

There are a number of traditional approaches to vocabulary improvement, all of which have merits as well as drawbacks. Traditional approaches to vocabulary improvement include:

- Extensive Reading
- Memorization of Word Lists
- Study of Word Derivation
- Use of Dictionary

Extensive reading has long been advocated as a means of vocabulary improvement, the theory being that students who read widely automatically learn more words. However, word frequency distribution studies show that a great majority of the words encountered in running content consist of high frequency words.

Clearly, a student will have to read extensively in order to encounter many new words. Yet due to the nature of context, they may meet them frequently enough to fully grasp and reinforce their meaning. Further, students who are in need of expanding their vocabularies are typically not students who read extensively in a wide variety of materials.

Another drawback to this method is that the reader, caught up in what is being read, may simply skip over unfamiliar words, rather than interrupt his or her train of thought.

Lastly, many students who are not accomplished readers will not read extensively. In fact, many will avoid reading because of a lack of fluency in reading.

The **memorization** of word lists with their meanings is another traditional avenue to vocabulary improvement. However, teachers of foreign languages have come to realize that rote memorization of words out of context usually does not lead to usage or a lasting grasp of vocabulary. The same applies to the use of this method in teaching English words. In addition, the student may become confused when a particular meaning for a word has been learned, and then the word is encountered in context in which it has an entirely different meaning.

The study of **word derivation** is another way of increasing vocabulary. Since many English words are derived from Latin and Greek, it is often assumed that a person who learns the meanings of Greek and Latin affixes and roots will be able, by a kind of decoding process, to determine the meanings of many words. While this may be generally helpful and useful in getting students to think about words and language, it is far from being an infallible approach. One of the drawbacks of this system is that an affix or root may have multiple meanings.

Pre, for example can mean earlier than or prior to (prehistoric); preparatory to (premedical); beforehand (prepay); or in front of (premolar).

Similarly, a number of different affixes may have the same meaning. For example, *in, il, im,* and *ir* all mean *not* (inconclusive, illogical, impractical, irreducible). Since these same four prefixes can also mean *in, within, toward,* and *on* (infuse, illuviation, immingle, irradiance), it is easy to see how students may become confused when they rely on this approach.

In addition, analyzing the parts of a word does not reveal the many different meanings it may have. As an example, the word "reflect" - - literally, bend back - - has a number of meanings including think, or have a bearing on, which cannot be inferred simply by knowing the derivation of its parts.

There is also the factor of student interest. The study of word derivation may appeal to those students who are interested in language, but not typically those whose need for vocabulary improvement is greatest.

Use of the dictionary in learning vocabulary is helpful, but this method is not usually considered to be of primary importance. When an unfamiliar word is encountered during reading, it is unlikely that a person will have a dictionary on hand. If time is taken to find a dictionary, the reader's train of thought is disturbed. Unfortunately, it is likely to be only the highly motivated individuals who will make the effort to look up a word, rather than those who are in need of vocabulary improvement.

Contextual analysis is the method by which a person is led to the meaning of a word by examining it within the framework in which it occurs. An individual is much more likely to make a word part of his or her vocabulary after having gone through the logical process of inferring its meaning, rather than simply memorizing it out-of-context. If a word has multiple meanings, the individual is more likely to choose the correct meaning when provided with contextual clues. In the belief that contextual analysis is the most effective means of vocabulary development, Taylor Associates has used this method as a basis of the Reading Around Words reading improvement program.

Context analysis has long been recognized as one of the more effective means of developing vocabulary, and structured content is likewise particularly appropriate for developing the strategies involved in the process of context analysis. When a reader is led to the meaning of an unknown word by examining it in the framework of structured context, which contains clues to its meaning, he or she is more likely to make that word a permanent part of his or her vocabulary because the logical process of inferring the meaning has been followed.

Contextual analysis has been widely analyzed as an effective tool in enhancing vocabulary skills. Greenwald (4), 1979 listed contextual analysis as a technique that can be used to increase a student's recognition vocabulary for a second language. Standal (6), and Schafer (7), 1978 listed contextual analysis as a strategy that promotes an effective vocabulary program. Clayton (1), 1970 suggested that among the skills that should continue to be developed beyond primary grades include vocabulary and concept development. She said an emphasis should be placed on contextual analysis. Nourie and Davidson (5), 1992 suggested that the most powerful vocabulary learning technique involves a combination of contextual analysis along with structural analysis.

Farstrup and Samuels (2) 2002, in *What Research Has to Say About Reading Instruction*, state that carefully planned and robust instruction using context clues should be part of a comprehensive vocabulary program. They site Graves (3) 2000, Stahl (6) 1998, and Sternberg (8) 1987, as stating that the use of context is the most widely recommended and most useful strategy to help students increase their vocabularies.

The contextual analysis approach was initially used by Taylor in the EDL Word Clues program of the 1960's. Taylor Associates then created the Reading Around Words program in activity book form in the 1970's, and finally developed the computer version for DOS in the 1980's. Since then, the program has been upgraded to Windows and Macintosh platforms. Contextual analysis strategies have been used by millions of students over the last forty years. The Reading Around Words program is currently being used in over 1,500 schools around the country.

Reading Around Words utilizes "structured" context to provide students with an efficient, practical way of internalizing the skills involved in contextual analysis. Structured context is specially prepared context used in conjunction with selected target words.

The structured context provides a wealth of concentrated practice in using a variety of contextual clues which can be used to unlock the meaning of an unfamiliar word. Since the target words in the Reading Around Words program are specially selected from graded vocabulary lists, students are assured of encountering a wide variety of "appropriate level" words without having to read extensively.

In essence, the Reading Around Words program teaches and provides practice in "life" vocabulary improvement skills that students will be able to utilize in all reading activities.

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E. Accelerated Comprehension

A vital study skill competency is a student's ability to read at accelerated rates (up to seven times his/her usual reading rate) with thorough understanding and to use preview strategies in preparation for reading. These skills are not only essential in continuing assignments in school, but are critical vocational competencies.

1. Comprehension Power (Levels 1-12)

Currently, 15 levels of Comprehension Power are available for reading levels 1-12. This total includes 3 levels of mature high-interest/low readability reading selections for secondary/adult beginning readers.

Goals of the Comprehension Power Program

The goal of the Comprehension Power Program is to improve the comprehension and study skill strategies through preview skimming, timed comprehensive reading practice and periodic comprehension questioning involving 25 major comprehension skills. Comprehension Power provides a library of 180 high-interest selections.

The benefits of the program include:

- extensive and varied reading experiences
- improved vocabulary
- preview practice
- more rapid and thorough reading
- comprehension and study skill strategy development

Nature of Comprehension Power Lessons

Students may be placed in Comprehension Power by Taylor Associates' CPA: Computerized Placement Appraisal or entered and placed by the teacher. Initial placement is typically at a student's Independent Reading Level.

Lessons may require 25-30 minutes to complete.

A student is initially presented with key words presented in a context sentence. The words may be flashed and typed in by the student or simply reviewed in context.

A preview is provided in each selection. It encourages the student to "link" information and form an overall picture of the content of the selection. The preview is untimed, but the student should proceed as expeditiously as possible. At the end of each preview, there are 3 multiple choice questions on levels A-C (levels 1-3) and Hi*A-Hi*C (levels 1-3), and one multiple choice question followed by 5 yes/no questions on all other levels.

After a brief, "About the Story," the student chooses a reading rate. CPA: Computerized Placement Appraisal provides a rate, but it can be modified by a student. Following the optional modification of a rate, the student should read the complete selection in either a line-by-line or full-frame buildup. Greater changes require teacher intervention. The full-frame buildup can be halted by pressing the space bar to pause to reread. The story is divided and read in a series of 7-9 segments. A "change rate" option is offered after each segment. Each segment is followed by 3 comprehension questions, for a total of 10 per selection on levels A-C and Hi*A-Hi*C and 20 per selection on all other levels.. A confirmation is presented for each correct answer, and an instruction to "Try again" is presented for each incorrect answer. After 2 incorrect answers, the correct answer is displayed. All are skill-based questions, designed to recap information, consolidate understanding and develop organizational thinking skills. Throughout the Comprehension Power lessons, students have repeat encounters with the following 25 skills:

Literal Understanding

- Recalling Information and Details
- Following Sequence of Ideas of Events
- Identifying Speaker

Evaluation

- Detecting Author's Purpose
- Understanding Persuasion
- Recognizing Slant and Bias
- Distinguishing Between Fact and Opinion
- Judging Validity
- Determining Relative Importance

Interpretation

- Main Idea
- Making Inferences
- Predicting Outcomes
- Interpreting Figurative Language
- Visualizing
- Paraphrasing

Appreciation

- Interpreting Character
- Recognizing Emotional Reactions
- Identifying Mood and Tone
- Distinguishing Between Fact and Opinion
- Identifying Setting

Analysis

- Comparing and Contrasting
- Recognizing Cause and Effect
- Classifying
- Reasoning
- Identifying Analogies

Following each lesson, a report of the student's comprehension percentage, rate, reading index and number of tries for the current lesson as well as the previous 5 lessons is displayed. Cumulative records, which may be displayed or printed, are maintained in Management. These records indicate rate, comprehension index and performance in the skill areas listed above. Since the same 25 skills are encountered in Taylor Associates' Guided Reading Program, a Combined Skills Report is also available through Management.

Comprehension Power Program Pedagogy

Comprehension in reading is a multi-faceted, cognitive activity involving understanding, interpretation, organization, evaluation and analysis. A reader utilizes a combination of these skills when comprehending a specific reading selection. He/she may utilize different skill "mixes" in different reading situations. Because of its complexity, reading requires the greatest attention of all of the communication skills. Most readers need, and can profit from, a *systematic program* that methodically develops the ability to use many comprehension skills in varied reading situations. Comprehension Power provides these experiences.

There are basically two major techniques that can be used to develop comprehension skills and capabilities: directed skill awareness and inductive skill awareness.

In directed skill awareness, students become aware of a variety of the nature of certain cognitive processes through specific comprehension skill explanation and application activities. In essence, students "learn by doing." These activities treat one skill at a time for emphasis; they are skill awareness and practice lessons, not just "reading experiences."

In inductive skill awareness, students gradually become aware of skills through numerous diverse reading experiences and by answering a wide variety of comprehension questions. These reading experiences involve a combination of skills, since reading comprehension is a global activity.

Taylor Associates' Comprehension Power Program primarily employs an *inductive* approach to the development of comprehension through its computerized reading lessons. As students read each Comprehension Power selection, they encounter twenty skill-building questions at various intervals during their reading. *This periodic questioning provides for a continuous growth of skill awareness, as students respond to a wide variety of comprehension skill "requests."*

In the Comprehension Power Program, students initially gain insight into comprehension processes inductively as a result of successive reading experiences. In most cases, they cannot verbalize any understanding of the processes. It is not likely that they would even comprehend an explanation of specific skill processes. References to specific skills such as "drawing conclusions," "comparing and contrasting," "sequencing," etc. are understood only after many experiences of recalling, organizing, reorganizing and analyzing content.

Comprehension skills evolve inductively as a result of broad experiences in thinking through varied typed of content. Inductive skill practice, then, prepares a student for more specific skill labeling and awareness later on.

Comprehension Power builds comprehension capability through short interval reading approaches. Because each reading selection is presented in segments, with questions posed and answers confirmed or corrected, the student's understanding of what has been read up to that point is continuously consolidated. This inductive and guided approach to building comprehension ensures that a student's understanding is sufficient, at each step of his reading, to cope successfully with each new array of comprehension skill "requests."

The Comprehension Power Program also uses the development of preview strategies to build comprehension. On reading levels 1-3, students encounter a brief preview of the reading selection with accompanying preview comprehension questions. On reading levels 4-12, students can optionally preview more extensively. At these more advanced levels, students are given "controlled" preview tasks that lead them to a generalized awareness of how to preview (read selectively), and how to synthesize these somewhat unconnected "glimpses" of the reading task to follow.

If Preview is selected, the student clicks on the spacebar and displays the preview content segment by segment. Each segment consists of a sentence or two from the beginning of a paragraph. The preview samples the majority of the paragraphs in the selection. These untimed displays allow the student to read, comprehend and assimilate each segment before the next is displayed. The preview format encourages the student to "link" the content of all of the preview segments and to acquire a general understanding of what the selection is about. The advantages of this form of "controlled" preview are as follows:

- Preview content is preselected, not left to the student's choice.
- Preselected preview content ensures more effective "bridging" from thought to thought.
- Each preview segment can be read thoroughly before proceeding.
- Students cannot "over-read" (read too much content during preview).
- Questioning during a controlled preview is predictable.

As in the Guided Reading Program, vocabulary controls were exercised in the preparation and writing of the Comprehension Power Program reading selections on levels 1-6. Vocabulary lists such as I/CT's Core Vocabulary (Levels 1-3), involving nine basal reading series, EDL's Core Vocabulary (Levels 1-6), the Harris Basic Elementary Reading Vocabularies, and for young adults, the Mitzel Functional Reading Word List were used as controls. Beyond Level 6, the key vocabulary treated is a function of the topics chosen.

Topics provide a wide range of informative and interesting reading material through which to develop comprehension capabilities. These include: adventure, contemporary issued, sports, biography, career/ consumer awareness, literature and life adjustment, etc.

The Comprehension Power Program does not focus on building reading (efficiency) fluency in reading as does the Guided Reading Program, but timed reading is employed to encourage students to develop the capacity for accelerated reading when time is short in study activities and to maintain high levels of concentration and attention. Timed reading, along with provisions for pausing, rereading and continuous provisions for the changing of rates, encourages maximum comprehension while simultaneously allowing for students' individual needs and approaches to reading.

History and Pedagogical Background

Taylor Associates' Comprehension Power Program is an outgrowth of the Practice Reading approach that has been used from the 1920's on, in which students were instructed to read segments of text and then answer questions covering a wide variety of skills. The practice of reading short selections and answering skill-coded questions to improve comprehension and reading strategies was emphasized heavily during the 1960's and 1970's in Educational Development Laboratories Study Skills Kits and Science Research Associates' Reading Improvement Kits. Millions of students benefited from these comprehension practice activities.

Hundreds of reading improvement courses, beginning in the 1940s, used timing techniques to build rates and improve comprehension. Many reading clinics today still employ timed reading using stop watches, timers, and clocks in conjunction with practice reading content to improve reading rate in comprehension.

In the late 1940s and 1050s, the Harvard Films and the Iowa Films were introduced. These motion picture techniques employed the presentation of lines of print in conjunction with timing to improve reading rate and comprehension. Unfortunately, the rate of presentation of all of these film series could not be adjusted. Users still reported reading improvement, nonetheless.

Still later in the 1960s, devices like the PsychoTechnics projector and the were introduced to improve reading rate and comprehension. These specialized reading devices presented both segmented lines of print as well as line-by-line pacing. Though the line-by-line presentation did not produce the oculo-motor improvement effected by such devices as the Controlled Reader (4) which employed left-to-right scanning presentations as well as line-by-line presentations (for more advanced readers), comprehension gains were still reported.

Simultaneously with these projection devices, three accelerated reading devices – the SRA Accelerator, the Shadowscope, and the Rateometer, which used bars or shadows or beads of light that moved down pages or print to force higher reading rates, were employed. The principal benefit of these approaches was to improve attention and concentration and provide timed practice reading which would, in turn, logically produce comprehension improvement during accelerated reading

A study by Gelzer and Santori (1) compared the benefits of timing approaches with left-to-right projection techniques to improve reading efficiency. This study used eye-movement recordings to document changes in reading efficiency. Superior gains in fluency development

right scanning presentations. However, all timed presentations produced some gains in comprehension.

Taylor initially created Comprehension Power in the 1980's. The program was revised in Dos and is presently available in Macintosh and Windows.

The introduction of the Comprehension Power series with its provision for line-by-line or frame-by-frame buildup in terms of rate of reading, the rereading options that are provided provide flexible approaches for advancing the reading rate of an already efficient reader to higher levels of competency. Further, the fact that the Comprehension Power selections are presented in segments, allows a student to employ much higher rates in a "burst" of intensive application. These reading segments (7 to 9 per selection) allow a student to put forth maximum rate and at the same time, stimulate maximum thorough comprehension. (More, then, would be possible if the entire selection was presented at a higher rate of coverage.)

Thus the use of practice reading with timing and comprehension has long been used to improve both accelerated reading and more thorough comprehension.

Research and Supporting References

The following Taylor Associates' Research Briefs report typical results of school programs using Comprehension Power in conjunction with other Taylor Associates' products. The program has been used for 15 years with over 3,000,000 students around the United States. The complete text of the briefs can be found at www.ta-comm.com.

Research Brief 21
Pilot Study conducted under the supervision of Harold Solan, O.D., M.A., Distinguished Service Professor, State College of Optometry, State University of New York
Nine 6th grade students, averaging 2 years below the mean on the Gates-MacGinitie test, and all identified as reading disabled, were enrolled in 12 one-hour sessions using Taylor' Comprehension Power and CLOZE-PLUS programs, followed by 12 one-hour sessions of Guided Reading and PAVE. Training took place between October and May.

Results: Gains averaged 1.7 Grade Level Equivalent as measured by the Visagraph. A 342% increase in comprehension (2.4 grades in 0.7 year), as measured by the Gates-MacGinitie test, was also achieved.

Research Brief 38
Beebe Elementary School – Arkansas
Students worked 30 minutes daily with 3 sessions of Guided Reading and PAVE per week for approximately 3 ½ months. Students also completed 1 session per week of CLOZE and 1 session of Comprehension Power.

Results: The project group outperformed the control group across all Visagraph measures and in the Stanford 9 standardized test. The overall average in Reading Comprehension for grade 2 students in the Project Group on the Stanford 9 test was +5.7, while the average for the control group was -4.7, a difference of +10.4. For 3rd grade students, the results showed a difference of 10.2 between the Project Group and the Control Group.

Research Brief 45
Talihini Junior High School – Oklahoma
Twenty-two remedial 7th, 8th and 9th grade students, in addition to their normal reading instruction, received 30 minutes of training with each Comprehension Power, CLOZE-PLUS and Reading Around Words for approximately 9 months. Students also received limited training in Guided Reading and PAVE weekly.

Results: The average Iowa Test of Basic Skills (ITBS) grade level improvement was 1.6 grade levels, with scores advancing from 4.9 on the March 2000 ITBS test to 6.5 on the March 2001 test. This grade level improvement represents an increase of 129% from the students' average yearly advancement of 0.7 grade levels in the years prior to instruction with Reading Plus.

1. Gelzer, A. and Santore, J. J. A Comparison of Various Reading Input Approaches, Journal of Educational Research, vol. 61, no. 6 (1968).

2. Long, Brenda (1992), Teaching Reading Comprehension Strategies to Sixth Grade Students to Improve Critical Thinking, M. S. Practicum, Florida: Nova University.

3. Taraban, Roman, et al. Reading Comprehension Development: Increasing Processing Capacity versus Increasing Knowledge, Paper presented at the annual meeting of the American Educational Research Assoc., Texas, 1995.

4. Taylor, S. E., and Frackenpohl, H., Controlled Reading, Huntington, New York: Educational Development Laboratories/McGraw-Hill Book Company, 1956, 1968, 1970 p. iv-154.

F. Selective Reading

The ability to read selectively at rates that greatly exceed a student's usual reading rate (two or more times more rapidly) to gain an overview of the nature of a selection in order to judge use or relevancy and to obtain needed reference information is a vital study skill. Students can only attain competency in these high speed selective reading strategies by conditioning in carrying out these practices.

1. Skim/Scan Program – (Levels 4-10)

Goals of the Skim/Scan Program

Today's world requires varied approaches for different reading objectives. Time does not always permit inclusive reading, and often a person will not need to read every word of an article or book. Efficiency often calls for selective high-speed or practice reading.

The purpose of TA's Skim/Scan program is to clarify, in the minds of students, the appropriate role and use of skimming and scanning, and to provide strategies which will allow them to become efficient and effective partial readers. In addition, the Skim/Scan program provides sufficient opportunity to practice with appropriate reading content in 161 lessons, permitting students to truly master these elite skills of selective reading

Current Use

The Reading Plus Skim/Scan program has only recently been introduced in three CD programs (Levels D, E, F, Levels F, G, H, and Levels H, I, J). By virtue of its recent release there are no current research or use reports to date. However, data and reports will be secured beginning with the 2002-2003 school year.

History and Background

Skimming and Scanning instruction has been a vital study skill area for years. High speed coverage at well beyond the rates that can be maintained during accelerated thorough reading, were popularized by the Reading Dynamics offering by Evelyn Wood (3). To clarify that this offering focused on selective reading (skimming and scanning), a research report by Taylor (2) on Air Academy Trainees using the Reading Dynamics program described the difference between rapid thorough reading and selective reading. Additional studies such as that conducted by Helen Graham (1) finally clarified the nature of skimming in contrast to rapid thorough reading.

During the 1960s Taylor introduced a practice book entitled "Skim/Scan," published by Educational Development Laboratories. This book was used in conjunction with a device called the "Skimmer" which used a moving bead of light to pace students. Later, a book series was released through Instructional Communications Technology, called "Skim/Scan." This series spanned levels 4 – 10 to provide extensive skimming and scanning practice.

Currently many college and universities offer instruction in skimming and scanning techniques as part of their reading development courses, but none offers the extensive practice contained in the Reading Plus skimming and scanning CD services.

Bibliography

1. Grayum, H.S. "An Analytical Description of Skimming: Its Purposes and Place as an Ability in Reading." Studies in Education, Thesis Abstract Series 44, Bloomington, Indiana: School of Education, 1953.

2. Taylor, Stanford E. "An Evaluation of 41 Trainees who had recently completed the "Reading Dynamics" program, 1st annual yearbook of The North Central Reading Association, 1962, 51-72.

3. Wood, Evelyn. Reading Dynamics. www.evelynwood.com

G. Decoding

Goals of the D-Code Program

Taylor Associates' D-Code program is available for levels 1-3. The program contains sixty letter clusters with seven words in each cluster. Clusters take approximately 40 minutes each to complete, with all sixty clusters being completed in approximately 40 total hours of instruction.

Decoding is the process of turning a printed symbol into the appropriate sound. This process is one of the most elemental processes in reading. After a word sound is established it must be understood for literal meaning. When these two processed function together with efficiency, fluent reading is established.

Decoding is a relatively low level cognitive process when compared with the many more complex tasks in reading for meaning. Decoding is a process that is responsive to simple conditioning and can be developed to the point of mastery in a relatively short period of time. Reading for meaning and the development of fluency is an ongoing process that develops over time.

The decoding process should be internalized and as rapid as possible. For beginning readers this process may be more focused and conscious. When readers need to decode unfamiliar words during reading, decoding should be as brief as possible, so as not to interrupt the fluent reading process and not to inhibit understanding.

The question then arises how to teach beginning readers decoding skills. Many students come to school having already internalized a process that enables them to realize letters, letters clusters, and printed words as sound. Most though will need specific instruction and directed practice to become competent and rapid in their decoding process.

The more conventional phonics systems of teaching decoding employ learning of rules and principles to unlock words. Research by Clymer (1) and others has cautioned that the use of conventional phonetic rules and principals is fraught with limitations and exceptions. Further, it is questionable that resorting to these rules and principles is as truly meaningful or efficient and rapid as a "letter cluster" approach to decoding.

Taylor Associates D-Code program employs a "letter cluster" approach to unlocking unfamiliar words known as the Glass Analysis, developed by Dr. Gerald Glass of Adelphi University. This technique does not rely on the memorization or application of the more usual rules and principals of

word attack. Rather words are typically unlocked by looking for internal letter clusters within the whole word that have been recognized and internalized in other more familiar words.

The D-Code program focuses on sixty basic vowel/consonant letter clusters. In each D-Code lesson, one vowel/consonant cluster is emphasized within whole words. The order of the clusters within the sixty-lesson sequence considers both frequency and level of difficulty. Level of difficulty refers to how easy or hard a given cluster is for students to learn based on experience with the Glass-Analysis approach in actual school situations.

In addition to the vowel/consonant clusters, the D-Code Program also deals with the common consonant letter clusters that the student will meet in actual reading. Twenty-five consonant clusters are introduced in the first twenty decoding lessons. Since consonant clusters are easier for students to learn, they require less formal instruction than vowel/consonant clusters. Each consonant cluster is given special emphasis the first time it is encountered in a D-Code lesson, then frequent practice and reinforcement are provided in subsequent lessons.

D-Code Lesson

Students may enroll in D-Code as individuals or in teams of two. Once the student has enrolled he/she will participate in four basic session activities for each cluster word. There are seven total words for each letter cluster. The first activity is "recording the word." First the narrator pronounces the word that appears on the computer screen. Then the student/team is asked to then record the word. The student clicks on the flashing "record" button. A time bar will appear, which reflects the amount of time the student has to record. The student/team then clicks on the "OK" button if the recording is satisfactory or he/she can rerecord it by clicking "record."

The next session activity is "typing the letters." During this session the student/team clicks on the letters that the (narrator provided) sounds make. The third session activity is "sounding of letters." In this activity the student/team is prompted to record the sounds that letters make. The student/team clicks the "record" button and records the sounds that the letters on the screen make. The final activity is the "take away letters activity" in which the student/team records sounds that are left after letters are taken away.

After the student/team completes these four activities they will then be asked to complete two of seven possible additional activities. These activities include:

1. Build Words – A student clicks on letters on the top half of the screen to complete make words. The narrator can read back parts of words. When the word is completed, the narrator will read the entire word.

2. Complete the Sentence – The student clicks on words to complete a given sentence.

3. Find Words – Here the student clicks on each word where a particular cluster is present. If the student clicks on a correct word, the narrator will read the word. If the student clicks on the incorrect word, the incorrect word will vanish.

4. Listen to Words – The student clicks on the word the narrator has pronounced.

5. Record the Sentence – The student reads and records a given sentence.

6. Type the Words – The student types in all the letters, including the cluster, to make words.

7. Unscramble – The student unscrambles the word by clicking or typing the letters in the correct order.

When the student/team has completed all activities involving a cluster word, he/she will automatically move onto the next cluster word and begin with the recording the word activity.

After all activities for all seven-cluster words are completed the student/team will be presented with three (for a single student) or six (for a team) "Could Be" words. "Could Be" words are actually not words but a grouping of clusters such as "scatch" or "atter." The student then records these "Could Be" words. These "could be" words encourage a student to display his/her decoding competence by converting letter clusters to sounds in words that cannot be recognized through meaning.

The final D-Code activity is optional. A student/team may choose to participate in a "beat-the-clock" activity. In this activity, the student/team practices with the seven cluster words. They are asked to recognize and read the word before the narrator does. One second per word is reasonable, but one half a second per word is desirable. The "beat the clock" activity can be repeated any number of times. When the "beat the clock" activity is completed the student will have the option to either click the "next cluster" button to advance to the next cluster or click the "stop" button to return to the D-Code title screen.

Pedagogical Background

Please see "The Process of Decoding for the Teacher of Reading" by Dr. Gerald Glass (2) in Appendix D.

Research on the D-Code Program

Brief # 25
D-Code CD-ROM Pilot Study (1999)
Thirty-eight second graders at L.B. Yancey Elementary in Henderson N.C. and 31 students from Seal Elementary in Douglass, KS participated. The average age of the total group ranged from 7.7 to 8 years. Subjects were selected and assigned to either a group receiving instruction with D-Code or a group receiving regular instruction without D-Code. Students were initially given a brief assessment to ensure that they had the appropriate basic decoding skills. The pre and post-test consisted of 30 "letter-clusters" with 2 words per cluster (60 items total). The post-test was identical to the pre-test.

Half the students received instruction with TA's D-Code program with a minimum of 3 sessions/week per student, with each session lasting at least 20 minutes. Students completed between 36 and 60 sessions in total. At Seal Elementary, both groups received classroom instruction in phonics as part of the basal text. At Yancey elementary, both groups received classroom instruction in phonics with the county's reading series. The post-test was conducted following instruction with D-Code.

At Yancey, for the group receiving no instruction with D-Code, the overall average increase was 1 word. The range of increase was 1 to 7; however only two students out of 19 showed an increase of 7 correct words. The group receiving instruction with D-Code showed an overall average increase 12 words, which represents an increase of 57% in the number of correct words. 74% of the students showed an increase of 7 words or more. The range of increase was 3-25, with about 63% increasing by at least 10 words. At Seal, for the group receiving no instruction with D-Code, the overall average increase was 7 words. Only seven out of sixteen students (44%) showed an increase of seven correct responses or more. The group receiving instruction with D-Code showed an overall average increase of 11 words, which represents an increase of 7 words or more; range was 7-23 with 8 students (53%) showing an increase of at least words.

The D-Code CD program was initially developed in cassette format with accompanying Activity Books. Each lesson was presented through a cassette recording and monitoring of response done by a teacher. The

following describes a study conducted in the 80's to assess the impact of instruction with D-Code Cassettes on decoding and word attack skills. The D-Code CD described above is based on similar principals and incorporates multimedia developments.

Brief #2
D-Code Study (1980)
Sixty students from the Patchogue-Medford School District, Long Island, NY partici-pated in the study. Students from grades 1-6, Grade 9 and a bilingual classroom were involved in the study. The basic methodology involved the administration of four instruments to measure decoding ability, before and after a three-month instructional period using TA's D-Code Cassettes. Elementary students were given five D-Code lessons per week for thirty minutes a lesson. On the secondary level, the sessions lasted twenty minutes, two times a week.

The following instruments were used to test decoding ability:

Test 1: Durrell Analysis of Reading Difficulty Word Analysis Section, Grade 1

Test 2: Durrell Analysis of Reading Difficulty Word Analysis Section, Grades 2-6

Test 3: 40 Words (Easier, D-Code Words)

Test 4: 40 Words (More difficult, D-Code Words)

Students were administered one or more tests, depending on their level of performance. Pre and post-scores were compared by means of a t-test between related means. No control group was included because of an agreement with the school.

All groups showed statistically significant (.01 level) increases in all four instruments with all groups and sub-groups of the population. The decoding ability of the students in the study had improved measurably and significantly after the three-month period in which the D-Code program was used.

Bibliography

1. Clymer, T. “The Utility of phonic generalizations in the primary grades.” *Reading Teacher*, 50, November, 1966
2. Glass, Gerald “The Process of Decoding for the Teacher of Reading.” I/CT Teacher Education, Monograph No.6

For all other D-Code pedagogical references see “The Process of Decoding for the Teacher of Reading” in Appendix D.