

The Need for Better School Vision Screening: The Use of VERA Vision Screening in a Community Setting

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ABSTRACT

Most school vision screenings test only distance visual acuity. The Modified Clinical Technique and the New York State Optometric Association (NYSOA) screening battery have been designed to provide more detailed screening, but each has drawbacks that have prevented widespread use. There is a need for a better functional school vision screening protocol that detects a wider range of learning related vision problems, does not require professional supervision, and can be easily administered by school personnel. The VERA (Visual Efficiency RAting) software program is designed to do both routine vision screening and screen for accommodative, vergence, and saccadic problems. Two studies are reviewed which show VERA to be effective in detecting visual skill problems. In a community setting, VERA has been used successfully for 4 years, and has resulted in numerous appropriate referrals of children to optometric offices for treatment. Over the course of one year, 12 children received vision therapy after being referred by one of the schools. The principal reported that all of the children demonstrated improved reading skills, and

that fewer special educational services were needed. After 4 years of use in 2 school districts, acceptance of the VERA protocol among school nurses, teachers and administrators remains high. The potential for VERA to provide qualified referrals to optometric offices that provide OVT services is significant.

Keywords: VERA, Visual Efficiency Rating, school vision screening, vision and learning, visual skills

The Need For Better School Screening

Vision is often considered as the dominant sensory system used in learning.¹ Hyperopia has frequently been identified as a visual risk factor for reading problems²⁻⁴ and recent studies have shown that uncorrected hyperopia affects both development of early literacy skills⁵⁻⁶ and visual motor skills.⁷ Many studies have shown that children with vergence, accommodative or ocular motor deficits are at greater risk for reading and learning problems.⁸⁻²⁰ Treatment of vision problems with optometric vision therapy (OVT) or prism has been shown in a group of studies to result in either a decrease in reading related symptoms²¹⁻²² or improved reading performance.²³⁻³⁰

The impact of vision on reading and learning results from the way children use their vision in the classroom. Children spend a large percentage of their day involved in near visual tasks, including classroom time, homework, and common recreational activities such as reading, computers, video games and texting. The average elementary school child spends 54% of classroom time involved in reading and desk work each day, with an additional 21% in copying tasks.³¹ This is generally followed by required reading and homework after school. Efficient near visual skills are even more important once a child has acquired basic reading skills and is using their reading skills to extract and learn information in other subjects.³²

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Optometric care of children with learning problems takes these visual demands into consideration and includes testing of vergence, accommodative, ocular motor and visual processing skills in the vision examination.¹ Unfortunately, ophthalmology disputes this notion³³, arguing that these visual skills are generally unrelated to learning. This disagreement has led to a wide variety of school vision screening policies among and even within states. Ten states currently have no requirements at all for school vision screening,³⁴ while 3 states have gone beyond screening and require mandatory eye exams by an optometrist or ophthalmologist when entering school. Two other states require eye examination for children upon entrance into special education services.³⁵ Current American Optometric Association policy recommends mandatory eye examination before first grade as the best approach for early detection and management of learning-related vision problems.³⁶⁻³⁷ This would certainly improve detection of refractive disorders, strabismus, amblyopia, and ocular pathology. However, some accommodative, ocular motility or non-strabismic binocular problems are less likely to be detected in such an examination because these conditions may develop later in life. Unless a comprehensive vision examination is completed that includes an assessment of visual function it may not always be possible to detect the more subtle problems in children that affect learning. Thus, annual or bi-annual examinations are necessary to insure prompt diagnosis and treatment of learning related visual problems. Unfortunately, such an examination schedule is rarely followed by parents and most parents rely upon vision screenings at school or in the pediatrician's office. These screenings often give parents a false sense of security about their children's eyes.

Vision screenings suffer from a number of problems. The most significant problem is that the vast majority of school and pediatrician screenings only test distance visual acuity³⁸⁻³⁹. While distance visual acuity screening will detect significant degrees of uncorrected myopia and astigmatism, amblyopia, and pathology that affects the visual pathway, others conditions such as hyperopia, binocular, accommodative, or ocular motor anomalies will not be identified. Secondly, parents may assume that if the child passes the vision screening that all aspects of vision have been tested and further examination is unnecessary.³⁶

Thus, there is a need for ongoing valid and effective vision screening throughout the school years that detects learning-related vision problems. A number of school vision screening protocols that go beyond visual acuity have been used over the years, but they have met with limited success. This realization led to The National Parent Teacher Association passing a resolution in 1999 calling for more visual skill testing to be incorporated in school vision screenings.⁴⁰ The Modified Clinical Technique has historically been viewed as the best school vision screening protocol, but it requires a trained eye care provider, is not cost effective for routine school use, and does not include functional or performance oriented testing other than a distance and near cover test.⁴¹ Instruments such as the Keystone or Titmus tester do screen for some aspects of binocular vision such as suppression, alignment and stereopsis, but they do not test performance over time, nor do they assess accommodation or ocular motility.

The most noteworthy attempt to use functional vision screening measures to detect learning related vision problems has been the New York State Optometric Association (NYSOA) screening battery.⁴² The test battery is designed to be used by parent volunteers trained by an optometrist and includes distance and near visual acuity, as well as screening tests for hyperopia, convergence, fusion (with the Keystone Telebinocular), stereopsis, saccadic skills, visual motor integration, and color vision. A validation study found sensitivity of 72% and specificity of 65% when compared to professional eye examination, and also found that the Snellen test missed 75% of the visual problems that were detected in the full examinations.⁴²

There have been relatively few published studies using the NYSOA since the initial validation study in 1985. Most of the studies are from one research group, suggesting that this battery is not widely used.^{15,43-48} Several practical concerns about this screening battery have probably contributed to its lack of acceptance with schools. The battery is lengthy and requires both optometric involvement and trained parent volunteers. A school nurse cannot do the screening alone, and schools are unlikely to provide enough of their own personnel for the screening.

A study conducted by Hatch in 1993 described VERA (**V**isual **E**fficiency **R**ating), a school screening test that addresses some of these concerns.⁴⁹ VERA is a software program that screens for binocular,

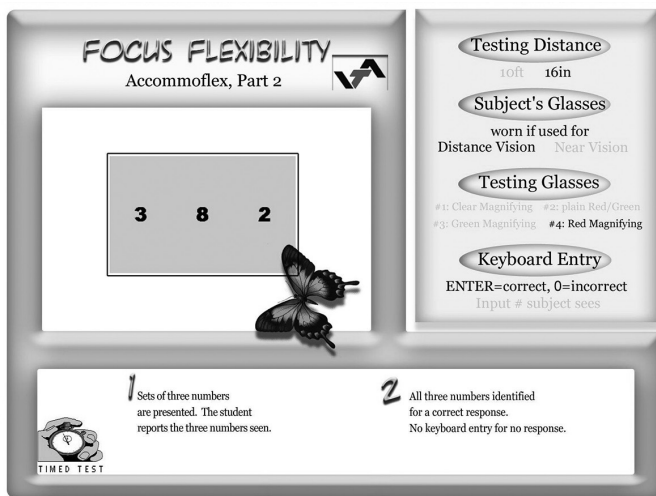


Figure 1: VERA test screen

accommodative and ocular motor disorders, in addition to routine vision problems. It is a two-tiered screening in which children must first pass visual acuity and hyperopia screening tests and a basic binocular vision screening consisting of suppression, stereopsis and alignment. If these tests are passed, a visual skills battery can be administered, including tests of vergence facility, accommodative facility, and saccadic tracking which are scored in combination. The VERA visual skills tests consist of a saccadic test, two accommodative facility tests, and a vergence facility test. The instructional sets are standardized and appear on the screen before each test. (Fig 1). Each of the test scores is compared to an age normed data base of 1500 children. The results are displayed as a percentile score for each test and a cumulative percentile score with categories of pass, fail and borderline.

VERA Tests

For the saccadic test, 15 empty boxes are arranged on the screen. Numbers are presented sequentially in each box in a pattern that simulates reading. The child is told to report the last number that is seen, which is entered by the tester. After a practice screen (or screens), the test consists of nine trials.

The accommodative facility test is a two part biocular task. The child holds a lens holder with one side having a red filter and a +1.50 lens, and the other side having a green filter with a -2.00 lens. Each screen contains a box with three 20/50 numbers that are only seen by one eye at a time. The child is instructed to make the numbers clear as quickly as possible and read the numbers out loud. The tester

enters "0" or "1" for incorrect or correct, and the next screen presents three new numbers seen by the opposite eye. The child must alternately stimulate and relax accommodation to clear the numbers. The test lasts for 60 seconds. For the second part of the test, the lens holder is reversed so that the child is now stimulating or relaxing accommodation with the opposite eye.

The vergence facility test consists of a random dot stereogram with a total vergence demand of 8 base out or 4 base in. When the stereogram is fused, the child is able to perceive a number from 1 to 4. The child reports the number that is seen and the tester enters this number. The test alternately presents base in and base out stereograms. This test lasts for 90 seconds. (A demo of VERA is available at <http://www.visualscreening.com>).

Hatch's study showed VERA to have 75% sensitivity and 93% specificity in detecting a range of vision problems which included acuity, refractive and visual skill problems, when compared to eye examination results in 36 subjects.⁴⁹ There was not a breakdown of how many subjects failed due to acuity or refractive concerns versus visual skill concerns. Hatch concluded that VERA could be effectively administered by a school nurse, and could have practical advantages over other comprehensive vision screening protocols.

A more recent study of the VERA program has just been published.⁵⁰ Since the 1993 study, VERA has been modified to be more efficient and not require additional hardware. The purpose of this study was to investigate the validity of the current VERA protocol. The study utilized 154 children in grades 3-6 from 6 different elementary schools. Results of VERA visual skills screening were compared to clinical optometric testing including step vergences at near, accommodative amplitude and facility, vergence facility, near point of convergence, and the Developmental Eye Movement Test (DEM). In addition to vision testing, the children were administered the Convergence Insufficiency Symptom Survey (CISS)^{22,51} and the Word Recognition and Fluency subtests from the Woodcock-Johnson III Tests of Achievement.⁵² Each child's teacher filled out the VERA classroom behavior survey. (Fig. 2) The results of this study showed that the sensitivity of VERA in detecting visual skills problems was 45% and the specificity of VERA was 83%. (Table 1)

STUDENT:

OBSERVATION DATE(S):

OBSERVER(S):

**BEHAVIORAL INDICATOR CHECKLIST
INDICATORS OF VISION PERFORMANCE DIFFICULTIES**

VISUAL

- ___ Difficulty with or avoidance of tasks requiring concentration, memory, reading or problem solving
- ___ Poor memory or concentration, trouble with spelling, vocabulary and grammar or inability to complete work during a given time frame
- ___ Complains of headache associated with near work
- ___ Complains of double vision or of blurry vision (far or near)
- ___ Covers or closes one eye when reading or doing near tasks
- ___ Complains of discomfort or inability to learn in tasks demanding consistent attention to fine detail
- ___ Tilts head extremely or works to one side of desk
- ___ Either eye turns in or out
- ___ Rubs eyes or forehead frequently

VISUAL-MOTOR

- ___ Poor physical or athletic performance (particularly poor spatial awareness)
- ___ Holds reading material very close to face
- ___ Writes in small, cramped style
- ___ Makes frequent errors in copying
- ___ Complains of words or letters jumping around
- ___ Loses place while reading
- ___ Uses finger to keep place
- ___ Handwriting is sloppy
- ___ Easily frustrated trying to draw figures

READING/LANGUAGE

- ___ Reverses letters or words
- ___ Omits words/letters when reading or writing
- ___ Spells poorly
- ___ Tires easily when reading
- ___ Performs below ability level for no obvious reason

ATTENTION

- ___ Trouble sitting still; fidgets frequently
- ___ Poor attention to reading
- ___ Responds to directions poorly
- ___ Behavior problems (particularly those related to frustration in the learning environment)
- ___ Displays tiredness or lethargy during the school day
- ___ Indifference to academic satisfaction and/or classroom work performance; and/or expressions of discouragement related to schoolwork
- ___ Trouble remembering or relating to material that is read

COMMENTS

Figure 2: VERA Classroom behavior survey

Table 1: Visual skill outcomes compared to VERA outcomes

Sample	Clinical test classification				Sensitivity = TP/ (TP+FN)	Specificity = TN/ (TN+FP)
	Fail		Pass			
	# TP	# FN	# FP	# TN		
All subjects	37	45	12	60	45.1%	83.3%
Symptomatic with reading delay ^a	10	8	1	11	55.6%	91.7%
High VERA classroom behavior survey ^b	14	8	0	5	63.6%	100.0%

^a Symptomatic subjects (CISS ≥ 16) with a reading delay (< 30th percentile on either word recognition or fluency)

^b Subjects scoring ≥ 8 on VERA Classroom Behavior Survey

Legend:

TP = True positives

FN = False negatives

FP = False positives

TN = True negatives

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VERA screening results are not designed to be used in isolation. The program's documentation recommends testing children who also show both unexplained reduced academic performance and classroom behavioral signs of a vision problem as defined by the VERA classroom behavior survey (Fig 2).⁵³ Sensitivity increased to 64% and specificity to 100% in smaller groups of children when overlays of symptoms, classroom behaviors and reading skills were included. (Table 1) The authors concluded that VERA is more accurate when targeting a population of underachieving children, and also suggested that the CISS may have value as part of school screening.

VERA is designed to minimize over-referrals.⁵³ Excessive over-referrals have the potential to reduce acceptance among parents and community eye care providers and result in pressure on schools to discontinue this type of screening.³⁸ With specificity of 83% to 100%, VERA meets the goal of minimizing over referrals.

Ideally, a higher number of children with visual skill problems would be identified during screening. VERA's sensitivity was only in the range of 45 to 64%, which means that roughly one third to one half of children with vision skill problems would be missed with VERA. Detecting even 50% of these problems in a school setting, however, is far better than current school screening methods which detect very few visual skill problems. Given the estimated prevalence of vision skill problems of 15-20% in the school aged population¹, and with even higher rates possible in

children with reading and learning problems^{13,54-55}, there are still very large numbers of children who could potentially benefit from the use of VERA for detection of visual skills problems.

The authors concluded that VERA visual skills screening has fair sensitivity for detecting visual skills problems, and that sensitivity improves when combined with a symptom survey, reading level, and a classroom behavior survey. The specificity of the screening is very good. The ease of administration and the ability of the screening to be performed by school personnel suggest that VERA has the potential to be a

significant improvement over current school vision screening protocols by enabling schools to more easily detect a wider range of vision problems that can affect school performance.

The Use of VERA in the Community

Two suburban school districts near the author's private practice, one with one elementary school and the other with five elementary schools, have been using VERA for both routine vision screening and visual skills screening over the past 4 years. Prior to this the districts' school vision screening programs consisted primarily of visual acuity testing with occasional use of the Titmus tester. The districts initially became interested in more effective vision screening after seeing students who had undergone OVT exhibit better academic performance and attention after therapeutic intervention.

The implementation of this new screening modality began with training of the school nurses in administration of VERA, and also included in-service presentations for other school personnel. Each VERA test begins with an instruction screen describing testing conditions and instructional set, which makes the tests very straightforward to learn. (Fig 1) The VERA routine vision screening served as part of the annual health and vision screening of children in selected grades. The vision skills screening was targeted for children who were thought to be underperforming in the classroom or who were exhibiting behaviors suggestive of a vision problem.(Fig 2) In New Jersey,

children with learning issues are first referred to a Pupil Assistance Committee (PAC) consisting of the classroom teacher, guidance counselor, school nurse and a member of the Child Study Team. Different teaching and homework strategies are developed and implemented, and potential referrals for speech/language, occupational therapy, or other interventions are discussed. If sufficient progress is not made after a period of time, the child is referred for a full Child Study Team evaluation consisting of psychoeducational evaluation, social evaluation, and possible referrals to professionals outside of the school.

The schools began using VERA in a variety of ways. In some cases VERA was part of the PAC or Child Study Team evaluation. In others, it was used with children who exhibited classroom behaviors suggestive of a learning related vision problem or who presented frequently to the school nurse with headaches or other possible vision related physical symptoms. As discussed above, VERA contains a classroom behavior checklist, and nurses and teachers were encouraged to use this as a guide to decide which children to refer for vision skills screening. The data from the validation study indicates that the sensitivity and specificity of VERA is maximized when combined with a score above 7 on this checklist⁵⁰.

Schools were encouraged to consider outside referral to an eye care practitioner only when 3 criteria were met: academic underachievement, the presence of classroom behavioral signs, and failure on VERA visual skills screening. This is consistent with the design of VERA, which has a stated goal of minimizing over referrals⁵³. The schools also wanted to prevent over referrals to enhance acceptance of VERA among community eye care providers and prevent dissatisfaction among parents who might perceive that their child was unnecessarily referred, resulting in increased pressure on the schools to stop providing the screening.

Professional ethics prevents schools from guiding referrals to a single practitioner, so a list of providers was made available to parents of children who were identified as in need of further care. An effort was made to inform and educate all of the local eye care practitioners about VERA and its routine vision screening and vision skills screening modules. As is probably the case in most areas of the country, the sensitivity of eye care practitioners, both optometric and ophthalmologic, to the connection between visual skills and learning is mixed. But the majority of

practitioners were receptive to the concept, including a local pediatric ophthalmologist. Practitioners were told that the VERA routine screening would also generate more frequent and more appropriate referrals for routine care due to the inclusion of a hyperopia screening test and standardized tumbling E visual acuity testing to prevent memorization and examiner bias.

Acceptance and interest in VERA within the smaller school district increased rapidly. About one year into the program, the district's special services director sent a letter to all parents in the district describing VERA, and the signs of learning related vision problems. This led to some parents requesting that VERA be done with their children, but it also had another effect. A local pediatrician responded by writing a "cease and desist" letter to the school principal, citing the American Academy of Pediatrics Statement on Vision and Learning³³. The principal of the school wrote back to the pediatrician, with the following comments: "the 12 parents who pursued OVT have all seen a noticeable improvement in their child", "most of the students were reading at least one grade level below, and after completing OVT, they rose to grade level", "we have been able to remediate learning problems before they are in need of services from our Child Study Team. This is the most important benefit."⁵⁶

To date, both districts continue to use VERA, and acceptance among nurses, teachers and administrators remains high. Approximately 90 VERA referrals have been seen in the author's practice over the past 4 years, and 90- 95% of these children were diagnosed with an accommodative, binocular or ocular motility disorder. The difference between VERA referrals and typical school referrals is that these referrals already include evidence of visual skills dysfunction. Parents have usually received written materials from the school and have been referred to websites that discuss the association between vision and learning. This has resulted in parents having a better understanding of their child's vision problems and the connection to classroom performance. During the past year an additional school district and a private elementary school near the author's practice have also begun to use VERA. The director of special services in the first district to use VERA reported recently that their district currently has the lowest rate of student classification for special education in the county⁵⁷. She states that screening and remediation of learning

related vision problems have been a significant factor in reducing the number of children referred for special education services.

The potential for VERA to provide qualified referrals to optometric offices that provide OVT services is significant. A significant barrier to growth may be the relatively small number of offices nationwide that provide in-office vision therapy⁴¹. It is hoped that as scientific evidence for the efficacy of OVT increases, along with awareness of the role that vision plays in learning, more practitioners will be interested in providing these important services.

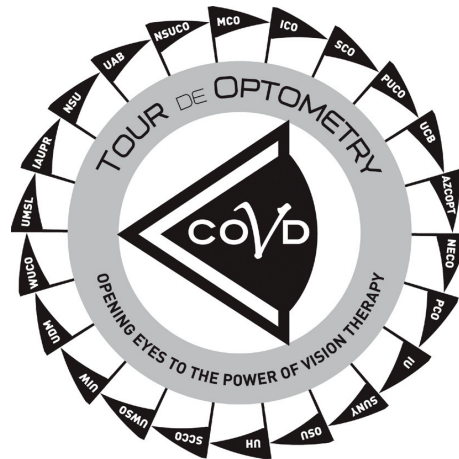
Conclusion: A recent study has shown that VERA has reasonable sensitivity and excellent specificity in detecting visual skill problems. VERA has been used in 2 school districts over the past 4 years and has provided numerous qualified referrals to a specialty VT practice. The ease of administration and the subsequent improvements in children who have undergone remediation of their visual problems has led to continued use of VERA in both districts. VERA can be used very effectively in a community setting to detect children with learning related vision problems.

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**THE MOUNTAIN STATES
CONGRESS OF OPTOMETRY
AWARDS A \$20,000 GRANT
TO COVD'S
TOUR DE OPTOMETRY
PROGRAM**



On behalf of the COVD membership, the COVD Board of Directors expresses appreciation to the Mountain States Congress of Optometry for the \$20,000 grant to support our Tour de Optometry school visit program.

The Tour de Optometry Program was initiated in 2005 with the goal of bringing the private practice experience of developmental optometry to the optometric educational clinical setting. The program was designed to increase awareness of behavioral

and developmental vision and vision therapy in optometry school students.

The Tour has continued to expand and with this year's \$20,000 grant from MSCO COVD is able to continue promoting optometric vision therapy to all the schools. This year's focus is on the "3 Ds of Seeing 3-D" (**D**iscomfort, **L**ack of **D**epth, and **D**izziness). Visiting the twenty-two schools is time consuming and costly to administer, and without the MSCO grant, we may not be able to visit all the schools every year.

**THE TOUR DE OPTOMETRY HAS BEEN
TREMENDOUSLY SUCCESSFUL AND IS JUST ONE EXAMPLE OF
COVD'S DEDICATION TO THE OPTOMETRIC COMMUNITY.**