THE VISUAL SCREENING OF TITLE I READING STUDENTS

■ **Roger A. Johnson, M.A., Ph.D.**
■ **Rose J. Blair, B.S., M.Ed.**
■ **Joel Zaba, M.A., O.D.**

Abstract

The New York State Optometric Association Vision Screening Battery (NYSOA) was administered to 186 fifth, sixth, seventh, and eighth graders who attended public schools which enrolled large numbers of economically disadvantaged children. Ninety-three of the children were enrolled in a federal educational program, Title I, that provides supplemental reading and other pedagogical services to eligible children. The other 93 children did not qualify for admission to the Title I program and served as a comparison group. The Developmental Eye Movement Test (DEM) was administered to 25 of the Title I children and the total comparison group. A chi-square statistical analysis revealed that the Title I students scored significantly lower on the Tracking, Visual Acuity-Near, Visual Acuity-Far, Fusion, Convergence, Visual-Motor Integration, and Color Vision subtests of the NYSOA Battery. Eighty-five percent of the Title I students failed at least one subtest of the NYSOA and 92 percent failed at least one subtest of the DEM. Significantly fewer comparison students failed the NYSOA and DEM.

Key Words

New York State Optometric Association Vision Screening Battery (NYSOA), Developmental Eye Movement Test (DEM), Title I-Part A of the Federal Elementary and Secondary Education Act, vision screening

Many American school children have difficulty in learning to read. The ability to read is necessary for social and economic advancement as well as for success in school. An increasingly competitive economy demands increasingly higher levels of literacy. "Children's inability to read higher complex material may cause difficulty in adulthood due to society's rising demands for literacy, not from declining absolute levels of literacy."[1]

As Bronfenbrenner, et al.,[2] note, "In a technological society, the demands for higher literacy are constantly increasing, creating ever more grievous consequences for those who fall short and contributing to the widening economic disparities in our society." Thus, in order to hold most of today's jobs, high school graduates must be more than merely literate. They must be able to comprehend challenging text, to perform sophisticated mathematical calculations using the latest in computer technology, and to solve various problems independently. The marketplace demands placed on high school graduates today are far more than those placed on their parents or grandparents. American school children without high levels of reading comprehension face an uncertain economic future.

With the long-term economic effects of being a poor reader and not graduating from high school being so severe, it is extremely important that all students become skilled readers by the third grade. According to Slavin, et al.,[3] children who finish the third grade without basic skills in reading are not likely to become high school graduates. Yet, according to Shaywitz and Shaywitz,[4] 17.5 percent of our elementary and middle school students have difficulty in reading.

There is a myriad of risk factors that are related to reading difficulties. There are both group and individual risk factors. Some groups of children are at risk for reading difficulties because they attend schools in which achievement is exceedingly low, live in low socioeconomic housing areas, speak a primary language other than English, or speak a dialect of English that is significantly different from Standard English. Some individual risks related to reading difficulties include: history of poor reading skills in one's family, auditory processing impairment, language impairment, or failure to learn prerequisite skills needed for reading.[1]

No single risk factor can predict future reading difficulties. The relationship between these risk factors and reading achievement occurs along a continuum. Children with reading difficulties fall along the lower tail of a bell-shaped normal distribution. As you approach the center of the normal curve of a reading distribution, you have a greater number of students with average reading scores. There is no categorical relationship that distinguishes a good reader from a poor reader.[1]

Title I-Part A of the Federal Elementary and Secondary Education Act, allocates money to local school districts in order to improve the basic literary skills (particularly reading) of children from low-income families. Title I was the first major federal aid specifically for children from low-income areas. Schools in high

poverty areas have developed school-wide programs that are supposed to emphasize high order reading and thinking skills.[1] When these programs were evaluated by Puma, et al.,[5] the evaluations showed that Title I students did not catch up with their classmates, but did not fall further behind.[5]

Vision, the process of deriving meaning from what is seen, is an obvious prerequisite to the normal reading process. Vision involves both the reception and cognition of the visual stimuli. Ocular tasks responsible for the reception of the visual stimuli include acuity, accommodation, convergence, fusion, and stereopsis. Motility tasks responsible for the reception of the visual stimuli include direct fixation, and saccadic eye movements. Cognitive tasks include the identification, discrimination, and identification of the visual stimuli. Visual motor integration is the ability to transfer and reproduce cultural symbols from one plane on to another. The majority of school systems screen for the acuity factor using a Snellen screening at distance viewing and, in some cases, at the near viewing distance. However, in most sections of the country, they do not screen for other important ocular and motility visual skills. The need for comprehensive visual screening has been established.[6,7]

Various investigators such as Suchoff and Mozlin[6] and Johnson, et al.,[7] have found significant visual problems among inner-city students. Included in the Johnson et al.,[7] study was significant failure rate in the motility-related vision skill of tracking.

Despite these inner city visual screening studies, additional research is needed to identify the specific visual skills which may contribute to a lack of success among Title I readers. Certainly, students with adequate vision can have reading difficulties. Certainly, inadequate vision may be only one of several factors that contribute to reading difficulties. It is extremely important to "rule out" children whose inadequate vision contributes to their lack of success in reading. As Solan[8] has recently noted, there is a need to determine more precisely the extent to which visual skill deficits contribute to reading difficulties. Among the most important of these visual skills necessary for reading is tracking, the ability of the eyes to move across a page of print.

The purpose of this research is as follows: (1) To perform a comprehensive visual screening of both Title I students and a comparison group in order to establish the prevalence of particular deficient visual skills which may differentiate these two groups; (2) To evaluate the tracking skills of both groups, using two separate visual screening instruments.

METHODS

Subjects

Subjects included 93 Title I students and 93 comparison students. Title I, Part A of the Elementary and Secondary Education Act, provides supplemental financial assistance to local school divisions in order to improve the educational performance of students who are academically at risk and who reside in areas with a high concentration of children from low-income families. Eligible children may be those classified as economically disadvantaged, children with disabilities, migrant children, homeless children, and/or those at risk of failing to meet academic standards.[1] The 93 comparison students attended the same schools but did not qualify for admission into this federally funded educational program. Both Title I students and the comparison students were enrolled in the fifth through eighth grade and had a median age of 12. Of the 186 students that were screened, 88 were boys and 98 were girls.

Screening procedures and statistical analysis of data

One of the researchers, assisted by undergraduate and graduate volunteers, screened both groups with the New York State Optometric Association Vision Screening Battery (NYSOA)[9] and the Developmental Eye Movement Test (DEM).[10] The NYSOA Battery includes the following nine subtests: Tracking, Stereopsis, Visual Acuity-Near, Visual Acuity-Far, Fusion, Convergence, Hyperopia, Visual-Motor Integration, and Color Vision. Each test was administered and scored according to the NYSOA protocol[9,a] on all 186 subjects. Lieberman, et al.,[11] offer support for the reliability and validity of this vision screening battery.

The Developmental Eye Movement Test (DEM), developed by Garzia, et al.,[10,b] is concerned with automatic number calling (visual-verbal numbering skills) which they consider a necessary component of a valid visual-verbal test of oculomotor functioning. Since the DEM utilizes a subtest which requires reading numbers in vertical array, the requirement for horizontal eye movements is eliminated. This vertical array of numbers is often used in reading tests. Garzia et al.,[10] noted a significant relationship between reading comprehension and this verbal tracking subtest. A second subtest presents numbers on a horizontal sequence which utilizes horizontal eye movements. A horizontal to a vertical performance ratio is established. This ratio assists in distinguishing poor oculomotor function from a deficit in primary visual-verbal automaticity. Based on the work of Solan and Suchoff,[12] a failure rate for the horizontal, vertical, and ratio subtests of the DEM was set at the 31st percentile rank, which is .5 standard deviations below the mean.

Four clinical response types have been described by Garcia, et al.[10] These response types are as follows: "Type I is characterized by normal performance in all subtest values. Type II is characterized by an abnormally increased horizontal time in the presence of relatively normal performance on the vertical subtest. The ratio would be higher than expected in this case. This behavioral pattern would be characteristic of an oculomotor dysfunction. Type III is typified by a higher than normal horizontal and vertical time but a normal ratio score. In this case there is a poorly developed automaticity and the increased horizontal time is found because the baseline performance is abnormal. The ratio of the two scores, however, is normal. This is a representative case of a basic difficulty in automaticity of number naming. Type IV is a combination of Types II and III. Vertical time, horizontal time and ratio scores are all abnormal. This case represents an example of deficiencies in both automaticity and oculomotor skills."

A chi-square statistical technique determined if significantly more Title I students failed the NYSOA Battery subtests and the DEM subtests as compared with a comparison group of students in the same grades at the same school. For the DEM vision screening measure, the full population of 93 Title I students was not available but we were able to test 25 of these students.

Table 1. THE PERCENTAGE OF FAILURE OF TITLE I STUDENTS VS. COMPARISON STUDENTS ON THE NYSOA				
	Sample Populations			
Subtests	Title I Students		Comparison Students	
NYSOA Subtests	N = 93	%	N = 93	%
Tracking	40	43[a]	15	16
Stereopsis	16	17	11	12
Visual Acuity-Near	18	19[b]	7	7
Visual Acuity-Far	31	33[a]	11	12
Fusion	39	42[a]	9	9
Convergence	25	27[a]	8	8
Hyperopia	7	7	3	3
Visual-Motor Integration	22	24[b]	9	9
Color Vision	27	29[a]	7	7
Fails at Least One Subtest	79	85[a]	45	48

[a] indicates p<.01 and [b] indicates p<.05

Table 2. THE PERCENTAGE OF FAILURE OF TITLE I STUDENTS VS. COMPARISON STUDENTS ON THE DEVELOPMENTAL EYE MOVEMENT TEST				
	Sample Populations			
Subtests	Title I Students		Comparison Students	
	N = 25	%	N = 93	%
Vertical	4	16	21	22
Horizontal	16	64[a]	14	15
Ratio	23	92[a]	10	11
Fails at Least One Subtest	23	92[a]	36	39

a indicates p<.01

RESULTS

Table I portrays the percentage of failure of Title I students compared with the comparison subjects on the NYSOA Battery. It shows that the Title ! subjects had more failures in each subtest than the comparison group. And, 85% of the Title I students failed at least one NYSOA Battery subtest, compared to 48% of the comparison subjects.

The differences in frequencies between the Title I and comparison students were subjected to a chi-square analysis to determine whether these differences were statistically significant. This analysis indicated the greater failure rate of the Title I students was at the .01 level of significance for the Tracking, Visual Acuity-Far, Fusion, Convergence, and Color Vision subtests as well as the Failing At Least One Subtest category. This analysis also indicated that the greater failure rate of the Title I students was at the .05 level of significance for the Visual Acuity-Near and Visual Motor Integration subtests. No significant differences appeared on the Stereopsis and Hyperopia subtests.

Table 2 depicts the percentage of failure of Title I students compared with the comparison subjects on the DEM. Some 92% of the Title I students failed at least one of the subtests. Sixteen percent failed the Vertical subtest; 64% of the Title I students failed the Horizontal subtest; and 92% failed the Ratio subtest. The differences in frequencies between the Title I students and the comparison subjects were subjected to a chi-square analysis in order to determine whether these differences were statistically significant. This analysis indicated the greater failure rate of the Title I students was at the .01 level of significance for both the Horizontal and Ratio subtests as well as the Fails At Least One Subtest category. No significant difference was found between the Title I students and the comparison subjects on the Vertical subtest. The failure rate on the Vertical, Horizontal, and Ratio subtests were used to identify Type I, Type II, Type III, and Type IV clinical response protocols.

Only one of the 25 Title I students was classified as Type I clinical response as he passed all three subtests of the DEM.

Twelve of the 25 Title I students were classified as Type II clinical response, oculomotor dysfunction, as they failed the Horizontal and Ratio subtests, and yet passed the Vertical subtest. Not a single Title I student was classified as Type III clinical response, a deficiency in automaticity of number naming, failing both the Vertical and Horizontal subtests and yet passing the Ratio subtest. Four of the 25 Title I students were classified as Type IV clinical response, deficiencies in both oculomotor skills and automaticity, as they failed all three subtests. Lastly, the remaining eight Title I students failed one or more of the DEM subtests and, therefore, did not fall into Type I - IV clinical response categories. These subjects may have failed the Vertical subtest, and passed the Horizontal subtest or passed both Vertical and Horizontal subtests, but failed the Ratio subtest.

DISCUSSION

The most significant finding of this research was the high failure rate of Title I students on both vision screening measures. Eighty-five percent of the Title I students failed at least one subtest of the NYSOA Battery. Title I students had higher failure rates than did the comparison group on Tracking, Visual Acuity-Near, Visual Acuity-Far, Fusion, Convergence, Visual-Motor Integration, and Color Vision subtests of the NYSOA Battery. These higher failure rates on the NYSOA subtests were statistically significant. Tracking, Visual Acuity-Near, Convergence, and Visual-Motor Integration are very important tests because they detect visual problems at 13 to 16 inches, a distance at which most school learning experiences occur. Since difficulty with near visual skills can interfere with the learning process, one may expect significant differences between Title I students and their counterparts.

Tracking, the ability to move one's eyes across a page of print, is particularly important in learning to read. Title I students who have difficulty with tracking are likely to have difficulty with reading, a visual-verbal process which incorporates language acquisitions and nearpoint visual skills. Vision is the guiding mechanism in the visual to verbal integrative process related to reading. With inadequate tracking skills, learning to read is likely to be difficult. As Richman[13] notes,

vision difficulties may not be the "fundamental basis of reading disability." Instead, it is more likely that "disabled readers have a visual-to-verbal decoding deficit" (whose presence) "increases the possibility for a reading difficulty to develop. Unless at risk students, such as those enrolled in Title I reading programs, are properly diagnosed and treated, some of these students may become so frustrated with their inability to learn that they may disrupt other students. They may become such behavioral problems that special programs or even alternative schools may be needed. Therefore, it is essential that classroom teachers work closely with visual care professionals, community volunteers, and community service organizations in order that each student receive a comprehensive vision screening and appropriate follow-up care. It is only through such mutual cooperation that compromised vision can be ruled out as a contributing factor in student learning difficulties. Without such cooperation, academically at risk students such as those enrolled in Title I reading programs may become the school dropouts, juvenile offenders, and/or the illiterate adults of tomorrow.

Fortunately, however, tracking is a visual skill which can be improved.[13,14] Special programs such as Title I reading programs should utilize behavioral optometrists who can help educators incorporate techniques into the curriculum in order to enhance tracking skills.

Moreover, 92% of the Title I students failed one or more of the DEM subtests. Only one Title I student was able to pass all three of the DEM subtests. Forty-eight percent were diagnosed with deficient oculomotor skills. No student, however, was diagnosed with a deficiency solely in number calling. Sixteen percent were classified as Type IV clinical response, demonstrating difficulty both in automaticity and ocular motility.

The higher failure rate of the Title I students on the horizontal subtest, 64%, as compared with the vertical subtest, 16%, of the DEM concurs with Johnson et al.'s[7] 1999 study that used juvenile offenders as subjects. This same result lends credence to the contention of Garzia, et al.,[10] that the Horizontal subtest, as opposed to the Vertical subtest, has not only a visual-verbal component that requires sustained visual attention, a visual to verbal response,

number recognition, but also accurate oculomotor tracking skills. As noted above, 43% of Title I students failed a Horizontal measure of tracking on the NYSOA Battery. The Title I students' poorer performance on the Horizontal subtest was anticipated, as performance on both Horizontal subtests requires the integration of visual and verbal information. Current results indicate that the DEM detects a higher incidence of tracking problems than the tracking subtest of the NYSOA. With the greater sophistication of the DEM it is not surprising that more children failed one or more measures of the DEM.

A high number of Title I students failed the color vision subtest. This high failure rate on color vision is possibly an artifact due to other perceptual problems which may be found in this particular sample. As the use of color-coded educational materials is prevalent in the classroom, further research in this area is indicated.

Since reading difficulties have a myriad of interrelated causes, it is extremely important that preschool and kindergarten children be screened by pediatricians, behavioral optometrists, speech-language pathologists, and educators in order to "rule out" problem areas which can be related to children having difficulty acquiring early language and literacy skills. This is the essence of the multidisciplinary approach. Behavioral optometrists should inform parents and teachers of the visual skills children should developmentally acquire in the interest of reading readiness. According to Snow,[1] "kindergarten screening has become reasonably accurate when a combination of skills is measured. Ideally, screening procedures should be quick and inexpensive; they should identify all or most children who have the specific problem; and they should mistakenly detect none or few children who do not have the problem."

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Corresponding author:
Roger A. Johnson, M.A., Ph.D.
Educational Curriculum and Instruction Department
Darden College of Education
Old Dominion University
Norfolk , VA 23508
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(757) 683-3235 (office)
(757) 683-5862 (fax)
 (e-mail)

Rose J. Blair, B.S., M.Ed.
St. Pius X   School
Norfolk, VA

Joel Zaba, M.A., O.D.
Pembroke One, Suite 105
281 Independence Blvd.
Virginia Beach, VA 23462
(757) 497-9576

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Hyperopia	7	7	3	3
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