Relationship Between Classroom Challenges and Vision Disorders

Dr. P. Kay Nottingham Chaplin, EdD
Introduction and Disclaimer

- 18 years in vision screening field

- Former Director/Lead Trainer – Vision Initiative for Children – West Virginia University Eye Institute – focus on Head Start, school nurses, pediatric primary care practices

- Member – Advisory Committee to the National Center for Children’s Vision and Eye Health at Prevent Blindness

- Consultant – Vision Screening Committee, American Association for Pediatric Ophthalmology and Strabismus

- Current Director – Vision and Eye Health Initiatives at Good-Lite and School Health Corporation

- Current Education and Outreach Coordinator for the National Center for Children’s Vision and Eye Health at Prevent Blindness

- My focus is to encourage age-appropriate and evidence-based vision screening – based on national guidelines and best practices – as part of a 12-component Strong Vision Health System of Care.
Describe 1 academic challenge of undetected and untreated vision disorders in the classroom.

List 1 website for finding resources to support your vision and eye health program.

List 2 classroom behaviors that may be related to vision.

Describe the difference between optotype- and instrument-based screening.
Current State of Children’s Vision in the U.S.

Vision disorders requiring treatment impact 1% to 6% of preschool-aged children and about 20% of school-aged children in the United States.\(^a\)

- Eye and vision disorders in children are a time-sensitive concern.
- If left undiagnosed and untreated, eye diseases and vision disorders in children can lead to permanent and irreversible vision loss and/or cause problems socially, academically, and developmentally.
- Nearly 94% of the vision problems leading to the impairment in preschool-aged children can be identified early during a vision screening resulting in earlier access to an eye care provider and improvement in vision.\(^b\)
- Only 41% of children ages 5 years and younger are screened for vision problems.\(^c\)

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Behaviors are not always related to vision.

A vision disorder is something to consider when the behaviors occur.

Conduct vision screening to rule out vision as a casual factor.

1. Talking in class
2. Notably quiet in class
3. “Spacy” children in their own world
4. Difficulty sitting still
5. Frustrated with academic work
6. Squinting during class activities
7. Clumsiness
Talking in class – Child said he talked because he was asking other students to help him read material on board.

Notably quiet in class – Child said she stopped looking at board . . . She couldn’t see material on board.

“Spacy” and in own world – Interrupt story time to come forward to see book pictures. “I can see that now!”

Difficulty sitting still – Up and moving in circle time or watching TV with brother. Loner and bored. Now sits and participates in group activities.


Screener and parent stories.
Frustrated with “academic work” – Before glasses, “things looked dusty”. Different child, happier, less frustrated.

Squinting during class activities – “Mommy! There are numbers on that circle on the wall!”

Clumsiness until receiving glasses – “I have realized through these screenings that vision can affect a child’s behavior, balance, and academic performance.”


Screener and parent stories.
Student with Frequent Headaches?

Screen vision to rule out vision disorder as causal factor.

MinnPost photo by Erin Hinrichs
• 2015 Vision in Preschoolers – Hyperopia in Preschoolers Study (VIP-HIP) found:
  o Children ages 4 and 5 years with uncorrected hyperopia (farsightedness ≥4.0 D) scored significantly worse on a test of early literacy than children with normal vision.
  o ≤ 4.0 D also had lower scores, but difference not statistically significant

• Test = TOPEL (Test of Preschool Early Literacy)
• Performance most affected:
  o Print knowledge subtest, which assesses the ability to identify letters and written words

Diopter defined

• “Diopter” refers to the strength of a prescription lens required to give a child the clearest vision possible. The higher the number, the stronger the prescription lens.

• A child requiring 4 diopters of correction in prescription glasses, or contact lenses, would likely struggle with blurred vision, crossed eyes, or both, and would see much better with prescription glasses.
317 2\textsuperscript{nd} and 3\textsuperscript{rd} grade students in 12 high-poverty schools in Baltimore City School District in phase 1

Poor baseline visual acuity and hyperopia associated with reduced reading achievement and worse baseline reading scores

Single School District Level

2015 study of low-income children ages 3 through 5 years screened in South Carolina’s Charleston County School District – after diagnosis and treatment with prescription glasses – found:

- Improvement in academic progress.
- Increase in focus during lessons.
- Increase in participation and classroom interaction.
- Improvement in confidence and behavior.

Early Identification & Treatment Make a Difference

- First grade reading ability found to be predictive of 11th grade reading outcomes, including:
  - Reading comprehension,
  - Vocabulary, and
  - General knowledge.

Children who lag in 1st grade but catch up by 3rd or 5th grade have good prognosis for future reading level.

Academic Considerations for Vision

- Improved GPA (reading and math) - more likely for hyperopes than myopes
- Increased satisfaction with school
- Reduced stress
- Improved cognition, attention span, and focus
- Improved test scores
- Less task avoidance and need for discipline
- Less labeling - ADD or ADHD
- Earlier identification leads to improved outcomes

Academic Performance of Oyler School Students after Receiving Spectacle Correction. Thesis by Kimberly L. Renner; Graduate Program in Vision Science; The Ohio State University, 2017

Four Steps to Simple Solution
Cast of Characters

NCCVEH:
- National Center for Children’s Vision and Eye Health at Prevent Blindness
  - Optometry
  - Ophthalmology
  - Family Advocates
  - Nurses
  - Public Health Professionals
  - Educators

AAP:
- American Academy of Pediatrics
- American Association for Pediatric Ophthalmology and Strabismus
- American Academy of Ophthalmology
- American Association of Certified Orthoptists
2 Approaches to Vision Screening

1. **Optotype-based screening**
   - Tests of visual acuity using optotypes to measure visual acuity as interpreted by the brain
     - *Quantifiable measurement of the sharpness or clearness of vision when identifying specific optotype sizes at a standardized distance*

2. **Instrument-based screening**
   - Instruments do not measure visual acuity
   - Instruments use an automated image acquisition and analysis system of the eyes to provide information about amblyopia risk factors:
     - Estimates of significant refractive error (hyperopia, myopia, astigmatism)
     - Estimates of anisometropia
     - Estimates of eye misalignment (some, not all)
“Not so great” charts . . .
NOT Recommended by NCCVEH and/or AAP

“Sailboat”

Allen Pictures

Lighthouse or “House, Apple, Umbrella”

Snellen

Tumbling E

Landolt C
Why **NOT** Recommended?

- The use of validated and standardized optotypes and acuity charts is important for an accurate assessment of vision.
- Charts not standardized.
- Children may not know their letters.
- Requires discrimination of direction, which is not sufficiently developed in preschool-aged children.
- Not well validated in screening environment.


Importance of Appropriate Tools

• “Visual acuity scores can be significantly affected by the chart design.” (p. 1248)

• Excluding optotype size, “each visual acuity level on a test chart should present an essentially equivalent task”. (p. 740)
National and international distance visual acuity eye chart design recommendations

- **1980 - National Academy of Sciences-National Research Council (NAS-NRC)**

- **1984 - International Council of Ophthalmology (ICO)**

- **2003 - World Health Organization Prevention of Blindness & Deafness (WHO)**

- **2010 – American National Standards Institute, Inc.**
Optotypes approximately equal in legibility

Horizontal between-optotype spacing = 1 optotype width

Vertical between-line spacing = height of next line down

Geometric progression of optotype sizes of 0.1 log units (logMAR, ETDRS)

5 optotypes per line

Optotypes black on white background with luminance between 80 cd/m² and 160 cd/m²

Similar recommendations across guidelines

Design guidelines = “ETDRS” or “logMAR” chart
Tips:
- Line outside optotypes
- 20/32 vs. 20/30
- 10 feet vs. 20 feet
Do the following eye charts fit national/international eye chart design guidelines? **Yes or No?**

Yes
Preferred Optotypes for Ages 3 to 6 Years

- NCCVEH
- AAP

- Recommend LEA SYMBOLS® and HOTV letters as optotypes


Preferred Optotypes for Ages 7 Years & Older

• AAP
  ▪ Recommends Sloan Letters

American Academy of Ophthalmology
  ▪ Recommends Sloan Letters and numbers


### Examples of evidence-based, developmentally appropriate optotypes

<table>
<thead>
<tr>
<th>Preschool</th>
<th>TK/K/Grade 1</th>
<th>Grades 2 - 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>EyE Check Screener with LEA SYMBOLS&lt;sup&gt;®&lt;/sup&gt;</td>
<td>LEA SYMBOLS&lt;sup&gt;®&lt;/sup&gt;</td>
<td>LEA NUMBERS&lt;sup&gt;®&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>HOTV</td>
<td></td>
</tr>
</tbody>
</table>

Matching cards can be used as needed
Would also suggest until children can identify letters out of sequence . . .
Screening Distance

- 10 feet from chart to child’s eyes

- New, standardized distance charts will be at 10 feet for children and adults

- 10/xx on left side of chart with 20/xx on right side – report 20/xx
Unacceptable Occluders Ages 3, 4, and 5 years

- Why unacceptable?
- Children can easily peek

- Hand
- Tissue
- Paper or plastic cup
- Cover paddle

**Examples of Occluders Recommended for CA**

<table>
<thead>
<tr>
<th>Preschool - Grade 1</th>
<th>Grades 2-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adhesive Eye Patch</td>
<td>Paddle</td>
</tr>
<tr>
<td>2-in Hypoallergenic Surgical Tape</td>
<td>Occluder</td>
</tr>
<tr>
<td>Occluder</td>
<td>Glasses</td>
</tr>
<tr>
<td>Occluder</td>
<td>Occluder</td>
</tr>
</tbody>
</table>

![Images of occluder options](image.png)
Would also suggest . . .
Examples of Near Visual Acuity Tools for Optotype-Based Screening in CA

<table>
<thead>
<tr>
<th>Examples of grade level appropriate charts</th>
</tr>
</thead>
<tbody>
<tr>
<td>TK/K - Grade 1</td>
</tr>
<tr>
<td>LEA SYMBOLS®</td>
</tr>
<tr>
<td>LEA NUMBERS®</td>
</tr>
<tr>
<td>Grades 2 - 12</td>
</tr>
<tr>
<td>HOTV</td>
</tr>
<tr>
<td>Sloan Letters</td>
</tr>
</tbody>
</table>
Would also suggest . . .
Stereoacuity Screening if NOT using Spot

PASS 2 Smile Test
Examples of Tools for Color Vision Deficiency Screening in CA

<table>
<thead>
<tr>
<th>Color Check Complete Vision Screener</th>
<th>Ishihara Color Deficiency Plates</th>
<th>Color Dx Pediatric</th>
<th>HRR Pseudoisochromatic Plates</th>
</tr>
</thead>
</table>

![Color Check Complete Vision Screener](image1)
![Ishihara Color Deficiency Plates](image2)
![Color Dx Pediatric](image3)
![HRR Pseudoisochromatic Plates](image4)
Different Waggoner test available . . .
2 Approaches to Vision Screening

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2. **Instrument-based screening**
   - Instruments do not measure visual acuity
   - *Instruments use an automated image acquisition and analysis system of the eyes to provide information about amblyopia risk factors:*
     - Estimates of significant refractive error (hyperopia, myopia, astigmatism)
     - *Estimates of anisometropia*
     - Estimates of eye misalignment
Instrument-Based Screening

• Use beginning at 12 months (AAP)

• Use instruments OR tests of visual acuity for children ages 3, 4, and 5 years (NCCVEH and AAP)

• Instruments at any age for 6 years and older if child or young adult cannot do test of visual acuity (AAP)


Instrument-Based Screening

Best practices for instrument-based screening should be evidence-based, also referred to as scientifically validated, and will evolve as technology changes. Screening devices require instrument- and age-specific pass/fail refractive error criteria. For a listing of recommended instrument-based screening protocols by the National Center for Children’s Vision and Eye Health, visit the California School Nurses Organization Website www.csno.org. In addition, up-to-date scientific evidence on instrument-based screening may also be found at www.csno.org.
Instruments Vetted by NCCVEH

Welch Allyn®
Spot™ Vision Screener

Welch Allyn®
SureSight™ Vision Screener

Retinomax
(Right Mfg. Co Ltd.-Tokyo, Japan)

Plusoptix
S12C Vision Screener
- Do not attempt to convert estimated refractive error to visual acuity value.
- Child could fail vision screening with instrument, but pass with conversion and miss opportunity for eye exam.

### Conversion Chart: Refractive State to “estimated” Visual Acuity

<table>
<thead>
<tr>
<th>Minus (-) Sphere</th>
<th>Estimated Visual Acuity</th>
<th>Plus (+) Sphere Ages: 5y to 15y</th>
<th>Plus (+) Sphere Ages: 25y to 35y</th>
<th>Plus (+) Sphere Ages: 45y to 55y</th>
<th>Estimated Visual Acuity</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.5</td>
<td>20/30-40</td>
<td>+2.00</td>
<td>+1.25</td>
<td>+1.00</td>
<td>20/20</td>
</tr>
<tr>
<td>-0.75</td>
<td>20/50</td>
<td>+3.00</td>
<td>+1.75</td>
<td>+1.25</td>
<td>20/25</td>
</tr>
<tr>
<td>-1</td>
<td>20/60</td>
<td>+3.25</td>
<td>+2.50</td>
<td>+1.50</td>
<td>20/30</td>
</tr>
<tr>
<td>-1.25</td>
<td>20/70</td>
<td>+3.75</td>
<td>+3.00</td>
<td>+1.75</td>
<td>20/40</td>
</tr>
<tr>
<td>-1.5</td>
<td>20/100</td>
<td>+4.25</td>
<td>+3.50</td>
<td>+2.00</td>
<td>20/50</td>
</tr>
<tr>
<td>-2.5</td>
<td>20/200</td>
<td>+4.75</td>
<td>+4.00</td>
<td>+2.50</td>
<td>20/70</td>
</tr>
</tbody>
</table>

[1] Spherical results are based upon minus (-) cylinder convention.

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*Not Recommended for conversion of screening results for children screened for amblyopic risk factors*
Vision Screening is . . .

- Part of a process...not a single event.

- 1 of 12 components of a strong vision health system of care.
Evaluating Your Vision Health Program

Annual Vision Health Program Evaluation Checklist

Evaluation Date: __________ Completed By: __________________________

Instructions: Review each component described below. Select the “Yes”, “No”, or other response that best describes your vision health program as it currently operates. Please note comments in the area indicated. Once you have responded to the questions in each of the components proceed to the “Vision Health System Action Plan” located on page 7 to identify areas for attention or improvement in your program.

1. Our program ensures that all parents/caregivers receive educational material, which respects cultural and literacy needs, about the importance of:
   a. Good vision for their child now and in the future.
   b. Scheduling and attending an eye exam when their child does not pass vision screening.
   c. Increased risk for vision problems in defined high-risk populations.

<table>
<thead>
<tr>
<th>Check Yes or No</th>
<th>Point of evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes  No</td>
<td>We have vision health information in all native languages of the families that we serve.</td>
</tr>
<tr>
<td>Yes  No</td>
<td>We discuss the importance of healthy vision as a part of proper child development in the general health information provided by our program.</td>
</tr>
<tr>
<td>Yes  No</td>
<td>We provide parents with easy-to-understand* information on the visual milestones for children at all stages of life. (*Information is written at an appropriate reading level, provides graphics as well as descriptions, and has been tested for ease of understanding.)</td>
</tr>
<tr>
<td>Yes  No N/A</td>
<td>Our parent/and or health advisory committee(s) have reviewed our vision health information for, content, clarity of instruction, cultural literacy, and reading level (4th to 6th grade level.)</td>
</tr>
<tr>
<td>Yes  No</td>
<td>We provide health information to parents of children with special healthcare needs that describe their increased risk for vision problems.</td>
</tr>
<tr>
<td>Yes  No</td>
<td>We have active Parent and Health Advisory Committees</td>
</tr>
</tbody>
</table>

12-Components of a Strong Vision Health System of Care

Our Children’s Vision Health System Action Plan

Directions: Review your responses from the program evaluation form and the notes written for each item. In all areas where “no” was the response selected, or your notes indicate a need for improvement, establish the next steps your program will take to improve efforts in that area. Once all responses have been accounted for, establish your top three priorities out of your needed actions, a date to review progress, and a completion date.

Needed actions:

Priority #1:

Priority #2:

Priority #3:

Visit http://nationalcenter.preventblindness.org/year-childrens-vision for information and resources that will help you improve your vision health program.

https://www.nasn.org/nasn-resources/practice-topics/vision-health
Resources . . .
A Historical Review of Distance Vision Screening Eye Charts: What to Toss, What to Keep, and What to Replace

P. Kay Nottingham Chaplin, EdD, West Virginia
Geoffrey D. Bradford, MD, West Virginia

Vision screening protocol and equipment guidelines differ among schools across the United States. Budget cuts are forcing many school nurses to reevaluate their vision screening programs, as well as items in their vision screening toolkits. School nurses tasked with inventorying these toolkits to determine which items to toss, keep, or replace are often left to wade through the ever-increasing number of options and a maze of guidelines. For school nurses who want their vision screening toolkit to include eye charts, national and international eye chart design guidelines are available to help ensure selected eye charts are standardized. A national consensus policy exists that recommends specific eye charts. And, a large body of vision screening literature is available to help school nurses make informed decisions. Current discussions suggest that LEA Symbols are appropriate for young children and Sloan Letters are a better choice than “Snellen” charts for older children.


Vision and Eye Health

Moving Into the Digital Age With Instrument-Based Vision Screening

P. Kay Nottingham Chaplin, EdD
Kira Baldonado, BA
Amy Hutchinson, MD
Bruce Moore, OD

Significant advancements in vision screening research are leading to improved design, functionality, and reliability of screening tools. Presently, two vision screening approaches are available to school nurses for children ages 3 years and older: optotypes-based screening and instrument-based screening. Optotype-based screening pertains to tests of visual acuity using optotypes (e.g., pictures, letters, and numbers), which children identify to determine visual acuity. Instrument-based screening pertains to automated devices that measure visual acuity, reflex, and eye movement using different algorithms (e.g., pictures, letters, and numbers), which children identify to determine visual acuity.


An Eye on Vision

Seven Questions About Vision Screening and Eye Health—Part 4

P. Kay Nottingham Chaplin, EdD
Kira Baldonado, BA
Susan Cotter, OD, MS, FAAO
Bruce Moore, OD
Geoffrey E. Bradford, MS, MD

Current evidence-based and best-practice vision screening and eye health approaches, tools, and procedures are the result of revised national guidelines in the past 3 years and advances in research during the past 18 years. To

To share with your preschool teachers:

Helpful info and statistics for grant proposal writing...

NASN Vision and Eye Health Resource

(National Center for Children’s Vision and Eye Health and NASN partnership)

https://www.nasn.org/nasn-resources/practice-topics/vision-health
Call to Action

- Share information about academic challenges and classroom behaviors with teachers.
- Evaluate your vision and eye health program.
- Help ensure follow-up to eye care when children do not pass vision screening.
Thank you for your TIME and ATTENTION. . .