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Hay, Trevor H., "Educating teachers on vision and reading: A source packet for the community-minded optometrist" (1996). *College of Optometry*. 1175.
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Educating teachers on vision and reading: A source packet for the community-minded optometrist

Abstract

In order to promote the recognition of visual dysfunction in the classroom, a presentation has been designed for optometrists to give to educators in a lecture and slide format with demonstrations. The behavioral definition of vision is the basis of the presentation, which also includes a discussion on vision development, visual symptoms in the classroom, vision screenings and vision therapy. These slides and handout formats are the follow-up of a prior thesis project.

Degree Type

Thesis

Degree Name

Master of Science in Vision Science

Committee Chair

Scott C. Cooper

Subject Categories

Optometry

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**EDUCATING TEACHERS ON VISION AND
READING:
A SOURCE PACKET FOR THE COMMUNITY-MINDED
OPTOMETRIST**

SLIDES AND HANDOUT

By

TREVOR H. HAY

A thesis submitted to the faculty of the
College of Optometry
Pacific University
Forest Grove, Oregon
for the degree of
Doctor of Optometry
May, 1996

Adviser:

Scott C. Cooper

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About the Author

During his optometric education, Trevor acquired a strong interest in vision therapy and learning disabilities. He plans to work in a multi-disciplinary clinic which will include vision therapy and primary care as well as outreach programs that entail school-age vision screenings.

Originally from Colorado, Trevor plans on exploring Alaska and New England before returning back. Interests include downhill skiing, snowshoeing, hiking, camping and photography.

Abstract

In order to promote the recognition of visual dysfunction in the classroom, a presentation has been designed for optometrists to give to educators in a lecture and slide format with demonstrations. The behavioral definition of vision is the basis of the presentation, which also includes a discussion on vision development, visual symptoms in the classroom, vision screenings and vision therapy. These slides and hand-out formats are the follow-up of a prior thesis project.

Acknowledgements

I would like to extend my appreciation to all of the following people who gave me their time and knowledge in the development of this project: Special thanks to Dr. S. Cooper for all of his time and assistance. He is one of the best at what he does! Thanks to Rochelle Moses for introducing me to this project and sparking my interest in vision and reading. Thanks to Dr. P. Kohl and Dr. R. Rosenow for keeping my interest in vision and reading. Thanks also go to Dr L. Mintle and Colin Stapp for their help with using all of those scary machines.

Introduction

This guideline is designed to assist optometrists and other vision care providers in developing a presentation to give to parents and teachers on the topic of vision and reading. The emphasis of this presentation is behaviorally oriented and focuses on vision development, visual symptoms in the classroom, vision screenings, and vision therapy.

Historically, children's vision screenings have consisted of little more than a distance visual acuity chart with the child calling out the lowest line of letters in which he or she can see. Consequently, learning-related vision problems go unnoticed and many children with significant visual problems will "pass" these screenings. Symptoms often appear when a child tries to use his or her vision in the classroom, therefore, the teacher will likely be the key observer in detecting signs of vision problems.

There are several purposes for this presentation, among them the wish to aid parents and teachers of all grade levels in understanding more about the intricate process of vision and to impress that a child's visual performance in the classroom may be detrimental in reaching his/her full potential. Also, it is intended to help educator's recognize what symptoms to look for with classroom related visual difficulties, and to be aware of what intervening options there are when cases such as these arise.

The contents of this thesis include 87 slides, the corresponding slide outline and a three-page handout to be used when presenting the information, as derived in the extensive outline format of a prior thesis (Dr. Rochelle Moses, 95'). Each slide follows along chronologically with the extensive outline and consists of key points, terminology and graphics. The handout consists of terminology (in alphabetical order) and their definitions which are applicable to the presentation and is meant for distribution to the audience. The slides and handout materials will make the information easy to understand as well as become a "take-home" source of information.

Glossary of Terms

- Accommodation** - Neuromuscular process that allows us to adjust focus and see clearly at different distances.
- Accommodative Amplitude** - The whole amount of focusing power that a person has. This decreases with age.
- Accommodative Facility** - The relative ease, speed and accuracy of adjusting focus for various distances.
- Astigmatism** - Refractive condition in which objects are partially focused in two different points in front of and behind the retina.
- Binocularity** - The degree to which both eyes function together.
- Convergence** - The ability of the eyes to turn inward to view a close object.
- Diplopia** - Double vision. Seeing two images at once.
- Divergence** - The ability of the eyes to turn outward to view an object in the distance.
- Esotropia** - One of the eyes turns in.
- Exotropia** - One of the eyes turns out.
- Farsightedness** (aka "Hyperopia") - Refractive condition in which the eyeball is too short and the image comes to focus behind the retina. Hyperopes are able to pass the basic visual acuity test more often than myopes, but are more commonly the less skilled readers of the two groups.
- Fixation** - While reading, the eyes pause while words surrounding this fixation point are read. Looking directly at an object.
- Fusion** - Making images from both eyes into a single image.
- Nearsightedness** (aka "myopia") - Refractive condition where the eyeball is too long and the image comes to focus in front of the retina.

Ophthalmologist - An ophthalmologist attends 4 years of medical school after college, followed by 2 years of residency, specializing in ocular surgery and disease.

Ophthalmoscopy - Procedure to assess the health of the back of the eye.

Optician - Fitting spectacles and grinding lenses are the focus of the optician's education. A certificate from the American Board of Opticianry (ABO) may or may not be necessary, depending on the state.

Optometrist - An optometrist attends 4 years of optometry school, studying the dynamics of ocular refraction and disease, the development of vision, and the treatment of visual functions. He/She is trained and licensed to practice vision therapy.

Pursuit - A smooth motion of the eyes, for example, when tracking a slowly moving target.

Retinoscopy - Procedure to measure refractive error objectively.

Saccade - Quick eye movements used to move from one fixation point to the next. The primary eye movement in reading. No visual information is seen for approximately 250 milliseconds.

Sight - The mere ability to see.

Tropia - A condition where one eye turns away from the point looked at by the other eye.

Vergence - The collective ability of the eyes to converge and diverge.

Vergence Amplitude - The range of vergence a person has.

Vergence Facility - The relative ease, speed and accuracy of vergence adjustments.

Vision - The interpretation of "seen information and subsequent processing/use of this information.

Vision Therapy - The training process for the improvement of visual perception and/or the coordination of the two eyes for efficient and comfortable binocular vision. There are many different types of vision therapy and many different conditions that are treatable through therapy.

Visual Discrimination - The ability to detect small differences in forms.

Vision and Reading

- o Vision and Reading - by Trevor Hay
 - ☰ I. Introduction
 - ☰ Vision and Education
 - The classroom demands an efficient visual system.
 - precise eye movements for reading.
 - accurate aiming of eyes.
 - sustained and accurate focusing.
 - flexible focusing.
 - ☰ Vision and Education
 - Correlation between level of visual skills and school performance.
 - ☰ Vision and Education
 - Several common visual limitations of the learning disabled population:
 - decreased visual acuity at distance and/or near
 - poor fusion and/or tracking
 - poor stereopsis
 - poor convergence
 - hyperopia
 - ☰ Vision and Education
 - Illiterate adults exhibit deficient visual skills that graduate students do not show.
 - ☰ Vision and Education
 - Correlation between visual deficiencies and juvenile delinquency.
 - ☰ Vision and Education
 - Research indicating that vision problems can be a contributing cause to juvenile delinquency.
 - ☰ Early Recognition of Visual Deficits
 - Visual deficits need to be recognized and corrected as early as possible for reaching full potential.
 - Teachers and parents are often the first to recognize vision problems.
 - ☰ Vision is a Learned and Developed Skill
 - Not all students have fully developed visual skills when reading instruction begins.
 - Infants use gross eye movements to view surroundings. These develop into fine and accurate eye movements which enable reading.
 - ☰ Vision is a Learned and Developed Skill
 - Poorly developed visual skills can be improved or corrected with appropriate intervention.
 - Improvement in these skills leads to a more efficient visual system and increased comfort of vision.

Vision and Reading

II. What Is The Difference Between Sight and Vision?

Sight

- The "alerting response" present in infants.
- 20/20 acuity - ability to see clearly at 20 feet the same letters that the average person can see at 20 feet.
- "Vision" is often overlooked.

Farsightedness (Hyperopia)

- Image is focused at a point behind retina.

Nearsightedness (Myopia)

- Image is focused at a point in front of retina.

Astigmatism

- Image focused both in front of and behind the retina.

Components of Vision

- Extra-ocular Muscles and Vergence Ability

Convergence

Divergence

Fusion

Tropia

Vergence amplitude

- The range of vergence that a person has.

Vergence facility

- The speed and accuracy in aiming the eyes.

Components of Vision

- Extra-ocular Muscles and Eye Movements

Saccade

- Quick jumping eye movements. No images are seen during saccades.

Pursuit

- A smooth motion of the eyes.

Fixation

- The eyes pause while words surrounding this are read.

Components of Vision

Cornea

- A fixed amount of power to focus light onto the retina.

Lens

- responsible for focusing.

Accommodation

- The eye's ability to focus - especially at near.

Accommodative amplitude

- The amount of focusing power.

Vision and Reading

- ⊖ Decreases with age.
- ☰ Accommodative facility
 - ⊖ The ease and accuracy of adjusting focus for various distances.
- ☰ Components of Vision
 - ⊖ Retina
 - ⊖ Receives what the eyes focuses and converts this light message into neural signals to be sent to the brain via the optic nerve.
- ☰ Components of Vision
 - ⊖ Brain
 - ⊖ Interprets the various visual messages received and combines them, resulting in perception, which is needed for reading.
- ☰ Retina to Brain Pathway
- ☰ III. How Does Vision Develop?
- ☰ Period of Greatest Plasticity
 - ⊖ At birth, very basic visual reflexes exist.
 - ⊖ Exposure to normal visual environment refines these reflexes.
 - ⊖ 0-6 years of age is the most sensitive period to learn visual skills.
- ☰ Period of Greatest Plasticity
 - ⊖ More difficult to learn or refine visual skills later on.
 - ⊖ School work requires finely-tuned visual skills in order for the student to succeed.
- ☰ Binocularity
 - ⊖ Develops in the area where the child pays the most attention.
 - ⊖ Depth perception is somewhat developed at 4-6 months.
- ☰ Binocularity
 - ⊖ Poor binocular fusion interferes with reading tasks, especially sustained reading. May cause eye discomfort and/or lack of comprehension.
- ☰ Eye Movements
 - ⊖ Infants have little oculomotor control until age 3 months.
 - ⊖ At age 6-7 years, efficient eye movements can be expected (assuming normal development). This is when most students are ready to read.
- ☰ Eye Movements
 - ⊖ Coordinated and skillful visual abilities vs. less developed oculomotor abilities.
 - ⊖ Inaccurate eye movements affect reading ability.
- ☰ Accommodation
 - ⊖ By 3-4 months, assuming proper visual stimulation, accommodation is nearly adult-like.
 - ⊖ Poor accommodative skills affect reading ability, especially smaller print.

Vision and Reading

- ☰ Color Vision
 - Color vision at birth is similar to wearing dark glasses.
 - Normal color vision occurs at age 2 months.
- ☰ Vision Perception
 - Development of vision perception begins with the sensory systems reinforcing one another.
- ☰ Vision Perception
 - Visual perceptual skills allow the student to recognize letters, their associated sounds, and their meanings.
- ☰ Vision Perception
 - Laterality, visual memory, figure-ground, and visual discrimination are all visual perception skills involved in reading.
- ☰ There is a significant relationship between developmental level of perceptual skills and reading achievement.
- ☰ Vision Perception
 - One of the most common perceptual deficits that optometrists see is letter reversal difficulties.
 - Adult-like directionality occurs around age seven.
 - Vision therapy has been shown to remediate reversal and laterality problems in many cases.
- ☰ IV. What Are The Visual Symptoms that A Teacher May See?
- ☰ Complaints at Desk
 - Headache
 - Ocular burn/sting/itch
 - Blur
 - Double Vision
 - Fatigue
- ☰ Symptoms may increase during reading and most symptomatic patients will also have decreased vocabulary and comprehension scores.
- ☰ Physical Appearance
 - Eye turn
 - Red or tearing eyes
 - Blocks one eye while doing desk work
- ☰ Eye Teaming
 - How well the eyes work together
- ☰ Other signs to watch out for:
 - Problems catching a ball or other playground activities.
 - Squints one eye.
 - Tilts head to one side consistently.

Vision and Reading

- Motion sickness.
- Avoidance.
- ☒ Eye Movements
 - Head turns with eyes to read.
 - Finger needed to keep place while reading.
 - Omits or re-reads lines without knowing.
 - Orients drawing or printing on page poorly.
- ☒ Accommodation and Refractive Status
- ☒ Mistakes "like" letters.
 - "b" = "d" = "p" = "q"
- ☒ Excessive blinking while reading or when looking far to near or near to far.
- ☒ Closes one eye while reading or copying.
- ☒ Holds reading material too close to eyes.
- ☒ Distance blur after desk work.
- ☒ Eye-Hand Coordination
 - Writes crooked, even with lined paper.
 - Needs finger to keep place.
 - Eyes don't steer hands - lack of orientation.
 - Left-Right confusion.
- ☒ Visual Form Perception
 - Mistakes words with similar beginnings.
 - Letter reversal.
 - Whispers to self while reading.
 - Traces letters or pictures with fingers.
- ☒ Significant Medical History
 - Medications?
 - Sinus or dental infections?
 - Other family members with ocular disease/anamolies?
- ☒ V. What Should A Vision Screening Include?
- ☒ The Vision Screening
 - Snellen Acuity - Near and Far
 - Ocular Motilities and Near Point of Convergence
 - Stereo Vision/Cover Test
- ☒ The Vision Screening-continued
 - Color Vision
 - Retinoscopy
 - Ophthalmoscopy
- ☒ VI. What Can Be Done For The Student With A Visual Deficiency?
- ☒ Treatment Options:

Vision and Reading

- ⊖ A. Glasses/Contacts
 - ⊖ A far-sighted student may claim that he/she doesn't need glasses to see clearly. The glasses relieve stress so that reading is more comfortable.
- ☰ Glasses/Contacts - continued
 - ⊖ Bifocals may be used for accommodative or vergence problems, myopia prevention and strabismus therapy.
 - ⊖ Teacher's should be aware of when the student should be wearing the glasses.
- ☰ Treatment Options:
 - ⊖ B. Vision Therapy
 - ⊖ Vision therapy definition
 - ⊖ Teaches students how to refine visual skills, which can increase chances of reaching his/her full potential.
- ☰ Vision Therapy - continued
 - ⊖ More and more research supports vision therapy.
 - ⊖ Vision therapy is not a replacement for reading instruction, although reading tasks are often included in therapy.
- ☰ Treatment Options:
 - ⊖ C. Surgery
 - ⊖ Considered after the possible benefits of vision therapy have been evaluated.
 - ⊖ The most surgical efficacy is realized when it is done in conjunction with vision therapy.
- ☰ VII. So I Suspect That I Have A Student With A Visual Problem....Who Is Most Qualified To Help My Student?
- ☰ The Importance of Selecting a Qualified Vision Specialist
 - ⊖ The 3 O's:
- ☰ Optician
 - ⊖ Fitting spectacles and grinding lenses are the focus of the optician's education.
- ☰ Ophthalmologist
 - ⊖ Attends 4 years of medical school after college prerequisites, followed by 2 years of residency, specializing in ocular surgery and disease.
- ☰ Optometrist
 - ⊖ Optometrists attend four years of optometry school after completion of a bachelor's degree, studying the dynamics of ocular refraction and disease as well as the development of vision. He/she is trained and licensed to practice vision therapy.
- ☰ The Appropriate Optometrist to Deal With a Student's Visual Problems:

Vision and Reading

- ▷ Realizes the relationship between underdeveloped visual function and poor reading performance.
- ▷ Considers all tasks that the student's visual system is required for.
- ☰ The Appropriate Optometrist to Deal With a Student's Visual Problems:
 - ▷ Provides vision therapy for students with visual system deficiencies.
 - ▷ Recognizes that vision therapy is not a "cure-all", but can remove barriers to educational progress.
- ☰ The Appropriate Optometrist - continued
 - ▷ Willing to consult with other professionals in order to help the student reach his/her potential.
 - ▷ Teacher's, educational psychologist, occupational therapists, physical therapist, chiropractor, counseling services, medical doctor or any other relevant professional.
- ☰ VII. Conclusion
- ☰ Final comments:
 - ▷ The visual system develops as the child ages and is "plastic" throughout life, especially in the developmental years.
 - ▷ Shortcomings in the visual system affect reading performance, especially binocular performance and saccadic eye movements.
- ☰ Final comments:
 - ▷ Deficits in the visual system may be improved with vision therapy.
- ☰ Any child having difficulty reading should be evaluated by an optometrist who is developmentally, behaviorally, or functionally oriented.
- ☰ Slide presentation by
 - ▷ Trevor Hay