

The Eyes Have It

By

Sherri Quinn
Harding High School
Saint Paul, Minnesota

Lauren Fields
Beeber Middle School
Philadelphia, Pennsylvania

In Collaboration with
Keri Norris, PhD
Centers for Disease Control and Prevention

Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

The Eyes Have It

by

Sherri Quinn
Harding High School
Saint Paul, MN

Lauren Fields
Beeber Middle School
Philadelphia, PA

Summary

This lesson is designed for a high school biology class. It will help to introduce the importance of vision health to students. Students will investigate how it feels to be visually impaired, understand different types of visual impairment, and learn how to treat and prevent visual impairments. It is expected that students already have an understanding of eye anatomy and physiology.

Learning Outcomes

- Students will be able to collect data of their vision using an eye chart.
- Students will be able to graph class data of vision.
- Students will be able to identify and explore four different types of visual impairment.
- Students will be able to explain treatment and prevention of visual impairments.

Materials

1. Eye chart and instructions for determining vision (1 per group of 4)
2. Masking tape (1 roll)
3. Meter sticks or measuring tapes(1 per group of 4)
4. Class set of Visual Impairment Chart (see resources for master copy)
5. Eye glasses representing visual impairments — cataracts, macular degeneration, glaucoma, and diabetes retinopathy. (Set up these five stations around the room.)
6. Please see resources on how to make glasses or order through **Lighthouse International** (<http://www.lighthouse.org>) by contacting their national office to receive an order form
7. Reading passages (see resources)
8. Lined paper available for students
9. Object for students to attempt to pick up during visual impairment simulation (for example, a water cup or pencil)
10. AIM ACTIVITY
11. Lecture notes
12. Poster making materials (large paper or poster board and markers)

Total Duration
4 hours

Procedures

Teacher Preparation

- Draw a graph on the board for class data. (See supplemental documents for an example.)
- Identify student groups for vision data collection and visual impairment simulations.
- Tape eye charts to classroom wall or hallway.
- Print and copy the Visual Impairment Chart for students.
- Set up visual impairment simulation stations or areas in the classroom.
- Gather materials for poster making.

Introduction

Duration: 30 minutes

Step 1

Following lessons on eye anatomy and physiology, this lesson will present students with information and simulations about vision impairments. Begin with creating groups of students (4 per group) and give them instructions on how to use the HOTV eye chart to get an idea of their own vision. They will need to measure with a meter stick or measuring tape 10 feet from the eye chart and mark that location with masking tape. Have them write down their own vision on a piece of paper.

Web Resources

Title: Prevent Blindness America

URL: <http://www.preventblindness.org/>

Description: This website contains the HOTV eye chart to be printed out for the first activity. It also gives the instructions on how to use the eye chart and information about visual impairments that the teacher may choose to read over ahead of time.

Supplemental Documents

Title: Class Vision Data Table

Description: This is an example of how to draw the vision data graph on the board. It is meant for the teacher to tally the data and draw bars representing the class vision

Step 2

Duration: 15 minutes

After student groups have assessed and documented their vision using the HOTV eye chart, the class should reconvene to create a class graph that displays the results of the vision testing. The teacher should ask each group to share their findings with the class, and the teacher should graph the data following the example provided. *This provides an opportunity for the teacher to elaborate on the differences between the types of refractive errors and explain how refractive errors can be improved after seeing a vision health professional.*

After the graph has been created using student data, the teacher should transition to **Step 3** by explaining that beyond the refractive errors that affect people within a population differently. Other major eye disorders that significantly affect an individual's vision. It is important to explore these eye disorders now, because the decisions that people make about their lifestyle can raise their risk for developing eye disease.

Supplemental Document

Title: Class Vision Data Table

Description: This is an example of how to draw the vision data graph on the board. It is meant for the teacher to tally the data and draw bars representing the class vision.

Title: Refractive Errors

Description: This website provides information about what causes the different types of refractive errors (farsightedness, nearsightedness, and astigmatism).

Step 3

Duration: 20 minutes

Distribute a copy of the Visual Impairment Chart to each student. Using the lecture supplemental lecture notes attached, the teacher should present material on the four major types of eye diseases, and the way each of them affects an individual's vision. During the lecture, the students should be filling out the graphic organizer using only the first two columns. The lecture is intended to stop after describing the eye diseases, so that students may explore the effects of each of the eye diseases using the simulation activity described in **Step 4**. The remaining two columns of the graphic organizer, and the section titled, My Prevention Plan will be completed during and after the simulation. The following Web resources provide additional factual information on eye disorders, and photographs/simulations showing how vision is affected in the case of each particular eye disorder, thus enhancing the lecture presentation.

Supplemental Document

Title: Major Diseases of the Eye and their Prevention and Treatment

Description: This set of lecture notes includes information about the characteristics, risk factors, and treatments of each of the following four eye diseases; cataracts, glaucoma, macular degeneration, and diabetic retinopathy. In **Step 3**, only the first main point of the lecture notes should be used, the second main point of the lecture notes will be used in **Step 5**.

Web Resources

Title: Vision Simulator

URL: <http://www.visionsimulator.com/retdetach.asp>

Description: This website offers an online vision simulator showing the vision distortions of each of the four eye diseases. At the site, just select an eye disease from the top, and move the white bar at the bottom to demonstrate the effect on vision as the eye disease advances without treatment.

Title: National Eye Institute

URL: <http://www.nei.nih.gov/photo/keyword.asp?match=all&narrow=Eye+Disease+Simulation>

Description: This website has a series of photographs that have been distorted to show the effect of certain eye diseases on vision.

Title: Lighthouse International

URL: <http://www.lighthouse.org/medical/eye-disorders/>

Description: This website contains detailed information about each of the four eye disorders, risk factors, treatments, and methods of prevention. This site is recommended for teachers to familiarize themselves with as preparation for presenting the lecture.

Title: Eyemaginations

URL: http://www.eyemaginations.com/sub.php?navigation_id=23

Description: This website offers short videos that explore each of the four major eye diseases and appears as though the video is animated from the point of view of being inside the eye. This resource would serve as a supplement to the lecture notes.

Step 4

Duration: 40 minutes

After the lecture, notes have been presented and students have completed the first half of their graphic organizer, students should break into groups to participate in a vision simulation. At each station, students should have the materials to write their name, read a passage, lift an object, and use motor skills using the glasses that simulate the impairment from one of each of the four different kinds of eye disease. Students will repeat each of the four activities at each of the four stations, and students will use a different type of vision impairment glasses at each station.

During the activity, students should fill out the section entitled, *My Experience* and *How Would this Affect My Future Life?* on the Vision Impairment Chart. They will be describing the ways their vision was affected while wearing the glasses, both now and on their future motor skills. Students can record feelings, specific incidences, and potential frustrations. All materials needed are listed in the materials section or are included in the supplemental materials.

Supplemental Document

Title: Vision Simulation Reading Passage

Description: This document is intended to be used at each of the vision simulation stations. The passage is repeated four times on the page, and therefore needs to be printed and cut apart, so that each station has one copy of the passage. The sentence students are reading is the mission of the Vision Health Initiative, a program operated by the Centers for Disease Control and Prevention (CDC).

Step 5

Duration: 20 minutes

After all students have completed each of the four vision simulation stations, the class will reconvene to complete the Vision Impairment Chart. At this point, each student should have completed the third and fourth sections of the chart. Using the lecture notes provided, the teacher should discuss with students the prevention strategies for developing eye disease, and students should brainstorm and identify the immediate life choices that will serve to prevent eye disease in the future. When all the lecture information has been disseminated, individual students should create their own action plan for preventing eye disease in the area titled, *My Prevention Plan*. Students should identify at least four things they can do immediately to begin protecting against eye disease.

Conclusion**Duration: 1 hour, 30 minutes**

After students have completed their Vision Impairment Charts, students will choose one of the four eye diseases discussed and create an informational poster about that specific eye disease. The poster is required to include; the name of the disease, the effect the disease has on the eye, the risk factors for developing the disease, and prevention strategies for reducing the risk for developing the disease. The posters should be informative, creative, and use language advocating vision health. Upon completion, students should hang posters throughout school hallways in order to promote vision health awareness among their peers. Students may use their notes and other online resources in the creation of these posters. The rubric for assessing these posters is included in the supplemental materials.

Assessment

The Vision Impairment posters stated in the conclusion will be assessed using The Eyes Have It: Visual Impairment Rubric.

Supplemental Document

Title: The Eyes Have It: Vision Impairment Poster Rubric

Description: This rubric establishes the expectations for assessing the Vision Impairment Posters and describes the required elements that should be included in the Vision Impairment Poster. This rubric can be used to assess the Vision Impairment Posters

Modifications**Extensions**

As an extension, students may create their own vision impairment glasses to use at home or to show their families. Students may earn extra credit for creating their own glasses, wearing them around the house for one hour, and writing a paragraph about the experience. The following website shows students how to create their own vision impairment glasses.

Web Resource

Title: Make Your Own Vision Impairment Simulators

URL: <http://www.sauerburger.org/dona/simulators.htm>

Description: This website provides instructions for creating the vision simulator glasses and an alternative to purchasing the vision simulator glasses.

Students may also earn credit for assessing older parents, guardians, or family members on the Lighthouse International: What's Your Eye Q? Quiz. The quiz can be found online and students can administer the quiz to their families to assess whether or not family members may benefit from making an eye appointment. Students may earn credit for administering the quiz by showing the teacher the answer of those that were given the quiz.

Web Resource

Title: What's Your Eye Q? Quiz

URL: <http://www.lighthouse.org/accessibility/q/>

Description: This webpage is an online quiz of 10 questions that helps to assess whether or not a visit to the eye doctor would be beneficial.

Other Modifications

Alternatively, teachers who are not able to purchase the glasses may create their own vision impairment glasses for the in-class vision impairment simulation. The instructions for making the vision impairment simulators can be found in the previous Web resource. Creating the vision simulation glasses during class might be beneficial for kinetic learners.

Education Standards

National Science Education Standards

SCIENCE AS INQUIRY, CONTENT STANDARD A

As a result of activities in grades 9–12, all students should develop

- **Abilities necessary to do scientific inquiry**
- **Understandings about scientific inquiry**

SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES, CONTENT STANDARD F

As a result of activities in grades 9–12, all students should develop understanding of

- **Personal and community health**
- **Population growth**
- **Natural resources**
- **Environmental quality**
- **Natural and human-induced hazards**
- **Science and technology in local, national, and global challenges**

Vision Lecture Notes

The Eyes Have It
Lauren Fields and Sherri Quinn
CDC's 2008 Science Ambassador Program

I. There are four major diseases of the eye

- a. Cataracts
 - i. A cataract is a clouding of the eye that causes blurriness
 - ii. Risk factors include age, excessive exposure to sunlight, cigarette smoking, high cholesterol, and diabetes
 - iii. As a treatment, the cataract is surgically removed
- b. Glaucoma
 - i. Glaucoma is usually defined as damage to the optic nerve, therefore causing visual impairment
 - ii. The impairment appears as a dark area in an individual's vision
 - iii. Risk factors include age, family history, being African-American or Hispanic-American, and having diabetes
 - iv. Treatment for glaucoma includes eye drops and medication, and/or laser surgery and treatment
- c. Macular Degeneration
 - i. Macular degeneration is a disease of the eye in which there is damage to the macula. The macula is the central part of the retina.
 - ii. This causes a cloudiness, and eventually a loss of central vision
 - iii. Risk factors include age, being Caucasian, a family history, light eye color, cigarette smoking, high blood pressure, high cholesterol, poor nutrition, and excessive exposure to sunlight
 - iv. There are no treatment options for 90% of macular degeneration cases
- d. Diabetic Retinopathy
 - i. This is the most common diabetes-related eye disease
 - ii. Diabetic retinopathy causes damage to the retina and potentially results in blindness
 - iii. The diabetes causes the blood vessels in the eye to become damaged and spots appear in a person's vision
 - iv. People with diabetes are most at risk for developing diabetic retinopathy
 - v. There are two surgeries for treating diabetic retinopathy. They include laser surgery, and a procedure called vitrectomy, which removes the vitreous fluid from the eye and replaces it with saline solution

Note: At this point, students should have completed the beginning of their charts, and the lecture should pause for students to complete the degenerative eye disease simulation stations. The lecture will continue after students have completed vision simulation, to complete their charts using the second half of the material.

II. However, these diseases can be prevented by taking action now to improve your vision health

- a. Almost all eye disorders can be diagnosed and treated through regular eye appointments
 - i. Eye doctor appointments should be made once a year
 - ii. Regular eye doctor appointments will also assist in correcting any refractive errors
 - iii. Make sure that while at the eye doctor the appointment includes exams where eyes are dilated.

- b. Eyes should be protected to prevent eye disease
 - i. Wearing sunglasses while outside can protect your eyes from excessive sun exposure
 - ii. Wearing safety goggles can prevent your eyes from injury

- c. Healthy eating, exercise, and lifestyle choices help to prevent eye disease
 - i. Keeping blood pressure low will decrease the risk for developing eye disease in that it prevents pressure from building up in the eyeball
 - ii. Eating healthy foods helps maintain a low blood sugar
 - iii. Not smoking decreases the risk for eye disease

References

1. Eye Disorders [online]. 2008. [cited 2008 July 23]. Available from URL: www.lighthouse.org/medical/eye-disorders/
2. Norris, K. Vision Health Initiative & Ways to Integrate Eye Health/Vision into Classroom Curriculum. PowerPoint presentation. [2008 July 21].

Visual Impairment Chart

The Eyes Have It
Lauren Fields and Sherri Quinn
CDC's 2008 Science Ambassador Program

Disease	Effect on Vision	My Experience	How would this affect my future life?

My Prevention Plan:

Instructions for Visual Impairment Simulation

The Eyes Have It
Lauren Fields and Sherri Quinn
CDC's 2008 Science Ambassador Program

For each simulation, students will:

1. Read the following passage:

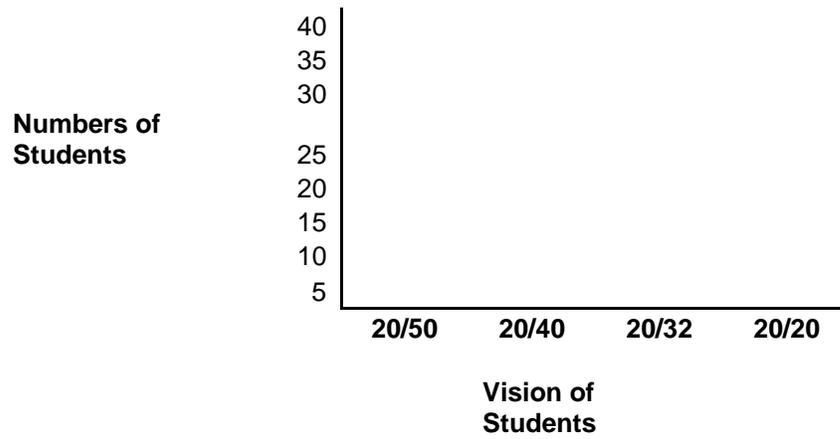
The mission of the Vision Health Initiative is to promote vision health and quality of life for all populations, throughout all life stages, by preventing and controlling eye disease, eye injury, and vision loss resulting in disability.

2. Write your name on a piece of paper.
3. Pick up the object provided. (cup, pen, etc.)
4. Aim at a target

Depending on the available materials, suggestions for the target include; ring around a cone, a ball in a small bucket, a bull's eye on a target, or a "pin the tail on the donkey" board. Teachers should use their own discretion in identifying the safest and most easily created target for the vision impairment simulation

Example Data Table for Class Vision Data Collection

The Eyes Have It
Lauren Fields and Sherri Quinn
CDC's 2008 Science Ambassador Program



Visual Simulation Reading Passage

The Eyes Have It
Lauren Fields and Sherri Quinn
CDC's 2008 Science Ambassador Program

The mission of the Vision Health Initiative is to promote vision health and quality of life for all populations, throughout all life stages, by preventing and controlling eye disease, eye injury, and vision loss resulting in disability.

The mission of the Vision Health Initiative is to promote vision health and quality of life for all populations, throughout all life stages, by preventing and controlling eye disease, eye injury, and vision loss resulting in disability.

The mission of the Vision Health Initiative is to promote vision health and quality of life for all populations, throughout all life stages, by preventing and controlling eye disease, eye injury, and vision loss resulting in disability.

The mission of the Vision Health Initiative is to promote vision health and quality of life for all populations, throughout all life stages, by preventing and controlling eye disease, eye injury, and vision loss resulting in disability.

Visual Simulation Reading Passage

The Eyes Have It
Lauren Fields and Sherri Quinn
CDC's 2008 Science Ambassador Program

Making A Poster : The Eyes Have It: Vision Impairment Poster Rubric

Student Name: _____

CATEGORY	4	3	2	1
Name of Eye Disease	The student has listed the name of the eye disease in a creative and engaging manner	The students has presented the name of the eye disease	The student has presented the name of the eye disease, but the name is hard to locate on the poster	The student has not listed the name of the eye disease
Effects of Eye Diseases on Eyes	The student has provided all of the following information in a clear and thorough manner; what element of the eye the disease damages, the way the disease effects vision, and potential visual impairments	The student has provided two of the three pieces of the following information in a clear and thorough manner; what element of the eye the disease damages, the way the disease effects vision, or potential visual impairments	The student has provided one of the three pieces of the following information in a clear and thorough manner; what element of the eye the disease damages, the way the disease effects vision, or potential visual impairments	The student has not provided any of the following information in a clear and thorough manner; what element of the eye the disease damages, the way the disease effects vision, or potential visual impairments
Risk Factors for Eye Disease	The student has included at least three risk factors, and made a distinction between risk factors that an individual does or does not have control over	The student has included at least three risk factors, but has not made a distinction between risk factors that an individual does or does not have control over	The student has included less than three risk factors and has not made a distinction between risk factors that an individual does or does not have control over	The student has not included risk factors
Eye Disease Prevention Methods	The student has identified at least three prevention methods for developing eye disease, and has advocated for vision health in language on a poster	The student has identified at least three prevention methods for developing eye disease	The student has identified less than three prevention methods for developing eye disease	The student has not identified prevention methods for developing eye disease
Risk Factors for Eye Disease	Several of the graphics used on the poster reflect an exceptional degree of student creativity in their creation and/or display.	One or two of the graphics used on the poster reflect student creativity in their creation and/or display.	The graphics are made by the student, but are based on the designs or ideas of others.	No graphics made by the student are included.
Definition of Eye Disease	At least 7 accurate facts are displayed on the poster.	5–6 accurate facts are displayed on the poster.	3–4 accurate facts are displayed on the poster.	Less than 3 accurate facts are displayed on the poster.