

How Technology Affects The Eyes

Team Number: Jackson Mid 4
School: Jackson Middle School
Project Area: Health and Medicine
Computer Language: NetLogo
Member's grade level: 7th

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What our project was mainly about was to see if technology affects the eyes. We surveyed people to see how long they spent on a device and how that affected the eyes. The results of this showed that headaches and time spent on technology have no effects on each other. We talked to an eye doctor to tell us more about the eye. We read articles about blue light, technology, and the eyes. This helped us greatly. The results of all of this showed that technology had no impact on the eyes, it depends on how long you spend on the device and the distance from your face.

We researched how modern electronic devices cause problems for a persons eyes. Our survey data showed that different grades and age groups in our school spend a different amount of time on their electronical devices per day. We used different online and article

based sources in our research to find what aspects of technology can cause in the human eye.

In order to solve our problem we needed to do research on a lot of aspects. Blue light has a very short wavelength and produces a high amount of energy. The sun uses blue light to help regulate natural sleep and wake cycles. Blue light from electronic devices have (HEV) High Energy Visible wavelengths that flicker easily that create a glare. This glare and flickering causes eye strain and headaches. We went to Google and searched "blue light", from there we went to many different articles and studied them. We created survey and administered it in science classes., It was given to 100 number of students in each grade 6th, 7th, and 8th at Jackson Middle School. 44 of the 100 surveys from each grade sixth, seventh, and eighth graders filled out our survey and returned it .(See Diagram 1). Grade levels were separated as we felt there might be different effects by age We studied the information to see different and similar results by grade and overall per the most important questions.

For a way to help understand more of what causes affect the eyes we went to Eye Associates of New Mexico as a team. There we met up with Karon Halana, an eye tech who assists doctors with surgeries on the eyes. She had us bring in questions, which included "*Does brightness matter? What part of the eye gets affected? How long does it take for the light to effect the eyes?*" Karon told us the usefulness about parts of the eye that is not affected, like the cornea. We found out that technology doesn't really affect the eyes, the main problem is when, where, and how long you spend on electronic devices that is the problem. If you stare at a device for hours straight, without blinking, this can make your eyes dry and tired. Also, the way we position our phones, tablets, and laptops causes our eyes to work harder to read closer or at a distance. The closeness of the device gives us eye strain making our eyes hurt, water and become sore and look tired, red and cause itching. By rubbing our eyes we can cause blurriness.

A good rule of thumb to prevent eyestrain is to do the 20/20/20 Rule. This means take a break every twenty minutes of staring at a screen at something that is a distance of twenty feet ahead for twenty seconds. She told us to look up "20/20/20 isn't everything"¹ . We looked it up and saw a video of four teachers seeing how some students would see with different eye sights. Our research indicated that technology isn't the only problem when dealing with the eyes. Besides the 20-20-20 rule, an individual could use

¹ "20/20 Isn't Everything – A Child's vision is critical to learning - Discover"
<http://www.discovervisiontherapy.com/2020-isnt-everything-childs-vision-critical-learning/>. Accessed 27 Mar. 2017.

artificial tears as a solution to dry eyes. The artificial tears, or eye drops, help hold the tears in that lubricate the eyes.

Our model was coded in NetLogo. We simulated the effects the phone screen has upon the human eye. The phone emits blue light rays to the eye. The human eye is sensitive to only one part of the electromagnetic spectrum, visible light. These colors are violet, indigo, blue, green, yellow, orange and red. Blue light has a very short wavelength and produces a high amount of energy. The sun uses blue light to help regulate natural sleep and wake cycles. Blue light boosts alertness and elevates moods. Blue light from electronic devices have (HEV) High Energy Visible wavelengths that flicker easily that create a glare. This glare and flickering causes eye strain and headaches. The light counter counts how many single ray is touching the eye it is counting the blue light rays that come from the phone. Every time the light counter reaches 100 it equals an hour. Or when the light counter reaches five hours, (500 rays) the eye turns pink , which represents dry eye. When the light counter is at 800 (which is 8 hours) the eye turns the color magenta to show eye strain. Our model is a simulation and not experimental.

Analysis of the data (see Table A) shows that if the devices are used for more than five hours some of the students will experience eye strain. It is important to take a break and even sometimes have a day off of electronics, like fasting. Our hypothesis was all types of technology will affect the eyes. When the Eye Associate explained to us that it's not the eye that gets affected but the brain, we realized that our hypothesis was incorrect.

Software, References, Tables: Appendices

Diagram 1: Survey Questions

Survey: How does technology affect your eyesight?

Write your answer

1. How old are you?
2. What grade level are you?
3. When you are on an electronic device for any length of time does your head start hurting?
4. After looking away from an electronic device do your eyes: Circle all that apply
 - a. Start hurting
 - b. Take a minute to refocus
 - c. Start watering
 - d. Become dry
 - e. None of the above

Check the box of your answer

5. How long do you spend on any electronic devices per day?
 - 30 minutes- 1 hour a day
 - 1 hours- 2 hours a day
 - 3 hours-5 hours a day
 - 5 or more
6. Do you wear or need glasses?
 - I need glasses
 - I have glasses
 - I don't have any glasses

Explain why or for what reason you need or don't need glasses:

7. Do you have to squint your eyes when looking at a computer?
 - All the time
 - Sometimes
 - Never

Thank you for taking our survey!

Survey Results:

Table A: Summary of Survey Results

age	grade	headache		pain	refocus	watering	dryness	time	headache-adjusted			
	6	1	5	0	0	0	0	4	0	2	3	
11	6	1	5	0	0	0	0	2	0	1	2	-0.1490779523
11	6	1	5	0	0	0	0	1	0	2	2	
11	6	1	5	0	0	0	0	4	0	3	3	-0.1081262781
11	6	1	5	0	0	0	0	4	0	3	3	-0.02730456147
11	6	1	5	0	0	0	0	4	0	3	3	-0.073046
11	6	2	2	0	1	0	0	3	1	3	2	
11	6	2	2	0	1	0	0	2	1	3	3	
11	6	1	5	0	0	0	0	1	0	3	3	
11	6	3	5	0	0	0	0	3	2	1	2	
11	6	1	1	1	0	0	0	1	0	3	2	
11	6	1	5	0	0	0	0	1	0	3	3	
11	6	1	5	0	0	0	0	4	0	2	3	
11	6	1	5	0	0	0	0	1	0	2	3	
11	6	1	5	0	0	0	0	1	0	2	3	
11	6	1	5	0	0	0	0	1	0	3	2	
11	6	1	5	0	0	0	0	1	0	2	2	
11	6	1	2	0	1	0	0	2	0	3	2	
11	6	1	2	0	1	0	0	4	0	2	3	
11	6	1	5	0	0	0	0	1	0	1	3	
11	6	1	5	0	0	0	0	2	0	2	3	

11	6	1	5	0	0	0	0	1	0	3	3
11	6	2	1.2.3	1	1	1	0	2	1	2	3
11	6	3	1.2.3	1	1	1	0	2	2	3	3
11	6	3	1.2.3	1	1	1	0	1	2	2	2
11	6	3	1	1	0	0	0	2	2	3	2
11	6	1	5	0	0	0	0	2	0	3	3
11	6	1	5	0	0	0	0	2	0	3	3
11	6	3	2	0	1	0	0	1	2	1	2
11	6	1	5	0	0	0	0	3	0	2	3
11	6	3	5	0	0	0	0	2	2	3	2
11	6	1	2	0	1	0	0	3	0	3	2
11	6	1	1.2	1	1	0	0	2	0	3	2
11	6	1	5	0	0	0	0	4	0	3	3
11	6	1	1.2.4	1	1	0	1	1	0	3	3
11	6	1	5	0	0	0	0	2	0	3	3
11	6	3	5	0	0	0	0	3	2	3	3
11	6	3	1	1	0	0	0	2	2	3	3
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11	6	3	5	0	0	0	0	2	2	2	3
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11	6	2	2	0	1	0	0	1	1	3	3
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11	6	2	1.2.3	1	1	1	0	1	1	3	2
11	6	1	5	0	0	0	0	2	0	3	3
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11	6	1	5	0	0	0	0	4	0	1	1
11	6	2	5	0	0	0	0	2	1	2	3
11	6	1	1.3	1	0	1	0	1	0	3	3
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11	6	3	1	1	0	0	0	1	2	3	3
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11	6	3	1	1	0	0	0	3	2	1	1
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11	6	3	2	0	1	0	0	1	2	2	3
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11	6	1	5	0	0	0	0	4	0	3	3
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11	6	3	2	0	1	0	0	2	2	3	3
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11	6	1	5	0	0	0	0	2	0	2	3
11	6	1	2	0	1	0	0	4	0	3	3
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12	6	2	4	0	0	0	1	3	1	3	2
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12	6	1	5	0	0	0	0	2	0	3	2
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12	6	1	5	0	0	0	0	3	0	3	3
12	6	1	5	0	0	0	0	3	0	2	3

12	6	1	2	0	1	0	0	2	0	3	3
12	6	1	5	0	0	0	0	4	0	3	2
12	6	3	5	0	0	0	0	4	2	3	3
12	6	1	5	0	0	0	0	2	0	3	3
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12	6	1	5	0	0	0	0	4	0	3	3
12	6	1	1.2	1	1	0	0	4	0	2	3
12	6	3	3	0	0	1	0	2	2	2	2
12	6	2	2	0	1	0	0	3	1	3	3
12	6	3	1	1	0	0	0	3	2	3	3
12	6	1	1.2.3.4	1	1	1	1	1	0	2	2
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13	7	3	2	0	1	0	0	2	2	2	3
13	7	3	1.2.3	1	1	1	0	2	2	2	2
13	7	1	5	0	0	0	0	3	0	3	3
13	7	3	5	0	0	0	0	2	2	3	3
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13	7	3	2	0	1	0	0	2	2	2	2
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12	7	3	4	0	0	0	1	2	2	3	2
12	7	1	2	0	1	0	0	1	0	3	3
13	8	2	1.2.3	1	1	1	0	3	1	1	2

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13	8	1	2.4	0	1	0	1	4	0	3	3
13	8	3	1.3.4	1	0	1	1	2	2	3	1
13	8	1	5	0	0	0	0	3	0	1	2
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13	8	1	5	0	0	0	0	3	0	3	3
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13	8	1	5	0	0	0	0	1	0	2	3
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13	8	1	5	0	0	0	0	3	0	3	3
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13	8	1	2.3	0	1	1	0	4	0	3	3
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13	8	1	3	0	0	1	0	1	0	3	3
13	8	1	3	0	0	1	0	2	0	2	3
13	8	1	1.3	1	0	1	0	2	0	2	2

Netlogo Code:

```
breed [phones phone]
breed [eyes eye]
breed [rays ray]
```

```
globals [
  glass
  light-counter
]
```

```
to setup
  clear-all
  set light-counter 0
```

```
  create-eyes 1 [
    set shape "eyeball"
    set color blue
    set size 3
    set xcor 6
```

```
  ]
```

```
  set glass ( patches with [ pxcor = -6 and pycor < 6 and pycor > -6] )
```

```
  ask glass [
    set pcolor white
```

```
  ]
```

```
  reset-ticks
```

```
end
```

```
to go
  move
  generate-rays
  tick
end
```

```
to generate-rays
  ask glass with [random-float 1 < intensity] [
    sprout-rays 1 [
      set color cyan
      set heading 90
    ]
  ]
end
```

```
]
end
```

```
to move
```

```
  ask rays [
```

```
    ifelse can-move? 1 [
```

```
      forward 1
```

```
      let targets eyes in-radius 2
```

```
      if any? targets [
```

```
        set light-counter (light-counter + 1)
```

```
        if light-counter = 500 [ ; when the light-counter is at 500 the eye to turn pink to
```

```
show dry eye
```

```
      ask targets [
```

```
        set color pink
```

```
      ]
```

```
    ]
```

```
    if light-counter = 800 [;when light-counter is at 800 the turns magenta to show eye
```

```
strain
```

```
      ask targets [
```

```
        set color magenta
```

```
      ]
```

```
    ]
```

```
  die
```

```
]
```

```
]
```

```
[
```

```
  die
```

```
]
```

```
]
```

```
end
```


Most significant achievement (each team member):

- *My greatest achievement was the amount of work we managed to accomplish in this time. I learned a lot from our research and group project and a little bit of coding to help my other teammates. I was also able to present to a group of judges and I have gotten better at doing presentations since then. There are a few moments where I didn't know what to do while typing our reports but when I finally understood what to do and I immediately got to work and typed what I felt should be included into our report. -Tiffany Chau*
- *My greatest achievement is the coding we have done. Even though I didn't do most of it, I still like how much we have done with it and that we understood how to do it, with a bit of help, of course. I still love how it turned out. Even though it might have not been what we have imagined, it was great in the end. - Gwenevere Caouette*
- *My most significant achievement was when we finished coding. Our coding is more of an illustration we do not have to keep working on making sure it worked we just show the judges. We also are three people, so it took a long time. We finally almost finished (well at this moment). That is my most significant. -Kyreen White*

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