Supplementary Materials
For
The Desunik’s Game of Sight Team
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Supplementary Material 1: Knowledge to Transfer Lesson Plan

for Students

Ages 6 to 8

- **What is vision/sight?**
  - Vision is your ability to see where you are. You can see objects around you. Vision is what allows you to walk to school, read the board, see your friends, and see your mom waving at you when you come home.

- **What are your eyes?**
  - Your eyes are the part of the body that allow you to see. You have two eyes.

- **What are the parts of your eyes?**
  - Cornea- Like a clear window that light can enter the eye through
  - Iris- Colored part of the eye
  - Pupil- Hole to allow light to enter
  - Eyebrow- Hair above the eye that prevents dirt from falling into the eye
  - Eyelash- Hair on the edge on your eye that prevents dirt from falling into the eye
  - Eyelid- Skin that covers the eye when you blink or sleep
  - Tears- Liquid that keep the eye wet and wash dirt out of your eye

- **How do your eyes work?**
  - Your eyes take a picture of what is in front of you and send the picture to your brain.
  - **Light inversion**
    - The picture that your eyes pick up are flipped upside down inside the eye and sent to your brain upside down. The brain will then turn them back to right side up.
  - **Colors/ color blindness**
    - Your eyes pick up on many different colors. But some people do not see colors correctly. They can confuse red and green or blue and yellow. These people are colorblind.

- **What are dangers to your vision?**
  - There are many dangers to your eyes like sharp objects and lasers which can cause an injury to the eye.
The sun’s bright lights can also be dangerous to the eye. This is why you must wear sunglasses when you go outside. Do not watch a solar eclipse. Even if you cannot see the sun, the harsh invisible light is still there.

Only read in an upright position. Reading while lying down or reading in a car can be harmful to vision. Also do not read in the dark. To keep your vision safe you must read in well lit areas.

Also do not spend more than 20 minutes of time on a computer or phone. The screen’s light can be harmful to your vision.

Do not watch TV too close to the screen, this also has harmful light.

If you get dirt in your eyes, you must not rub your eyes. This can scratch them. Instead have an adult help you rinse your eyes out with water.

How to keep eyes healthy for good vision?

Remember to always wear your sunglasses when going outside to play. If you are playing a dangerous sport, always wear a helmet. A head injury can be harmful to your vision.

Eat healthy foods such as carrots, apples, sunflower seeds, fish, and spinach.

Go outside and play. You should take a break from your screens often.

What are refractive errors?

People who can’t see far away are called nearsighted. They have good vision for close up objects, but may struggle to see the board in school. If you struggle to see things in the distance, you may need glasses.

People who cannot see things close to them are called farsighted. They have good vision for far away objects but may struggle to see their phones or paper they are writing on. Being farsighted also makes it difficult to read because the words are fuzzy. People who are farsighted need reading glasses, a special lens that magnifies things that are near.

People can also have astigmatism. This is when the eyes are an unusual shape. This makes the pictures from the eyes blurry.

Why wear glasses?

Wearing glasses can be important. If you have a vision issue, wearing glasses will correct it. It can make your life easier. If you are nearsighted, glasses can help you see the board. If you are farsighted, glasses can help you read.

Although glasses make what you see clearer, it is important not to wear glasses if you do not need them. If you have perfect vision, wearing a friend’s glasses can be harmful to your vision. Although it seems fun, looking through weird lenses can strain your eyes and give you a headache.

What do Eye Doctors do?
Eye doctors prescribe glasses. They will test your near and distance vision to see how well you see. They will tell you if you need glasses or not. If you visit an eye doctor and are told to buy glasses, trust them. They are trained professionals.

How do blind people see?
- Blind people use canes to feel for objects around them. They use the cane to avoid walking into walls or falling down stairs. If you see someone suffering from blindness, you can help by offering to help him cross the street.
- Blind people use a special alphabet called braille, which contains patterns of bumps. Blind people will feel the bumps and know what letter they are touching. This allows them to read without seeing the letters in front of them.

Ages 9 to 11

- What is vision/sight?
  - Vision is your ability to see where you are. You can see objects around you. Vision is what allows you to walk to school, read the board, see your friends, and see your mom waving at you when you come home.

- What are your eyes?
  - Your eyes are the part of the body that allow you to see. You have two eyes.

- What are the parts of your eyes?
  - Cornea - Clear outer layer that light can enter the eye through
  - Iris - Colored part of the eye
  - Pupil - Hole in the iris that allows light to enter the eye
  - Lens - Focuses the light on the back of the eye
  - Retina - Back layer of the eye. This contains many cells that transfer the light image into electrical signals.
  - Optic Nerve - Thick wire made of nerve cells that send light images to the brain
  - Vitreous - Clear gel that fills the eye
  - Macula - Place in the back of the eye where light rays are focused allowing the clearest of vision
  - Conjunctiva - A mucous layer that covers the front of the eye and lines the eyelids
  - Tear Duct - Produces tears which lubricate the eye when you blink and wash dirt and dust out of the eye

- How do your eyes work?
  - Your eyes take a picture of what is in front of your and send the picture to your brain.
  - Light inversion
Because light enters through the pupil, the small entrance to your eye, the rays of light invert themselves. This causes an inverted light image to be reflected onto the retina. This inverted image is sent to the brain, where it is again inverted to be interpreted as normal.

- **Colors/color blindness**
  - Cones of the retina absorb light of certain colors. There is a cone for red, a cone for blue, and a cone for green. Some people lack a cone for a specific color. This is where color blindness comes from.

- **What are dangers to your vision?**
  - There are many dangers to your eyes including sharp objects and lasers which can cause an injury to the eye.
  - The sun’s bright light can also be dangerous to the eye. This is why you must wear sunglasses when you go outside. Do not watch a solar eclipse. Even if you cannot see the sun, the harsh light is still there.
  - Only read in an upright position. Reading while lying down or in a car can be harmful to vision. Also, do not read in the dark. To keep your vision safe you must read in well lit areas.
  - Also do not spend more than 20 minutes of time on a computer or phone. The screen’s light can be harmful to your vision.
  - Do not watch TV too close to the screen, this also has harmful light.
  - If you get dirt in your eyes, you must not rub your eyes. This can scratch the cornea and make your eyes irritated. Instead, have an adult help you rinse your eyes out with water.
  - Conjunctivitis- This is a disease that can be caused when you do not wash your eyes. Bacteria will infect the mucus layer of your lids. The infection will cause redness to the white part of your eyes, itchy or burning eyes, tearing eyes, or blurred vision. When you have this, you must go to an eye doctor to get treatment.

- **How to keep eyes healthy for good vision?**
  - Remember to always wear your sunglasses when going outside to play. If you are playing a dangerous sport, always wear a helmet. A head injury can be harmful to your vision.
  - Eat healthy foods such as carrots, apples, sunflower seeds, fish, and spinach.
  - Go outside and play. You should take a break from your screens often.

- **What are refractive errors?**
  - People who cannot see far away are called nearsighted. They have good vision for close up objects, but may struggle to see the board in school. If you struggle to see things in the distance, you may need glasses.
  - People who cannot see things close to them are called farsighted. They have good vision for far away objects but may struggle to see their phones or paper they are
writing on. Being farsighted also makes it difficult to read because the words are fuzzy. People who are farsighted need reading glasses, a special lens that magnifies things that are near.

○ People can also have astigmatism. This is when the eyes are a different shape. This makes the pictures that the eyes take blurry.

● Why wear glasses?
  ○ Wearing glasses can be important. If you have a vision issue, wearing glasses will correct it. Glasses can make your life easier. If you are nearsighted, glasses can help you see the board. If you are farsighted, glasses can help you read.
  ○ Although glasses make what you see clearer, it is important not to wear glasses if you do not need them. If you have perfect vision, wearing a friend’s glasses can be harmful to your vision.

● What do Eye Doctors do?
  ○ Eye doctors prescribe glasses. They will test your near and distance vision to see how well you see. They will tell you if you need glasses or not. If you visit an eye doctor and are told to buy glasses, trust them. They are trained professionals.

● How do blind people see?
  ○ Blind people use canes to feel for objects around them. They use the cane to avoid walking into walls or falling down stairs. If you see someone suffering from blindness, you can help by offering to help him cross the street.
  ○ Blind people use a special alphabet called braille, which contains patterns of bumps. Blind people will feel the bumps and know what letter they are touching. This allows them to read without seeing the letters in front of them.

Ages 12 to 14

● What is vision/sight?
  ○ Vision is your ability to see where you are. Vision orients you in 3D space. Vision is what allows you to walk to school, read the board, see your friends, and see your mom waving at you when you come home. It is very important that you protect your vision.

● What are your eyes?
  ○ Your eyes are essential organ of the body which allow you to see.

● What are the parts of your eyes?
  ○ Cornea- Clear dome-shaped layer of the eye. As the outermost layer, it acts as a protective surface. It is clear to allow light to enter.
  ○ Iris- Colored part of the eye with a hole in the center. This part regulates the amount of light rays entering the eye by constricting in intense light and dilating in darkness.
○ Pupil- Hole in the iris that allows light to enter the eye.
○ Lens- Focuses the light on the back of the eye by bending the light rays.
○ Retina- Back layer of the eye. This contains many cells that transfer the light image into electrical signals. The cells contain rods and cones which pick up on light and colors to recreate the image we are seeing.
○ Optic Nerve- Where all of the nerves of the retina come together and exit the eye. The optic nerve carries the electrical signal created by the retina to the brain.
○ Vitreous- Clear gel that fills the eye and allows light to travel between the lens and the retina. Holds the eye in its spherical shape by creating internal pressure that pushes on the outer walls of the eye. This is very similar to the way air fills a balloon.
○ Macula- Place in the back of the eye where light rays are focused allowing the clearest of vision
○ Sclera- White outermost layer of the eye
○ Ciliary Muscles- Change the shape of the lens to allow for focusing at the distance or at near.
○ Conjunctiva- A mucous layer that covers the front of the eye and lines the eyelids to keep the eye lubricated.
○ Tear Duct- Produces tears which lubricate the eye when you blink and wash dirt or dust out of the eye

● How do your eyes work?
○ Your eyes take a picture of what is in front of you and send the picture to your brain.
○ Light inversion
  ■ Because light enters through the pupil, the small entrance to your eye, the rays of light eventually invert themselves. Because of this, an inverted light image is reflected onto the retina. This inverted image is sent to the brain, where it is again inverted to be interpreted as normal.
○ Colors/ color blindness
  ■ Cones of the retina absorb light of certain colors. There is a cone for red, a cone for blue, and a cone for green. Some people lack a cone for a specific color. This is where color blindness comes from.
○ Depth perception
  ■ You do not need both eyes to be open to see. If you close one eye you are still able see across the room. However, eyes need to work together to interpret depth.
  ■ Depth perception is the ability to see in three dimensions. It comes from our brain’s ability to put together two 2D images. Each eye will see a slightly different image. When the two images are put together to form
one, it is called convergence. People with convergence issues often see double at near or far.

- Depth perception requires two eyes (binocular vision). Those that have one eye that significantly dominates the other (monocular vision) typically suffer from depth perception problems. This can be referred to as having a lazy eye. In majority of cases due to misalignment of the eyes named strabismus.

- Strabismus- Your brain only uses the image from one eye. Because of this, one eye will look directly at the image being focused on while the other will drift.

- Amblyopia- Similar to strabismus in that the brain will only use the image from one eye, however in this case, one eye is significantly stronger than the other. One eye may have perfect vision, and the other will suffer from vision loss.

- **What are dangers to your vision?**
  - There are many dangers to your eyes including sharp objects and lasers which can cause an injury to the eye.
  - The sun’s bright lights can also be dangerous to the eye. This is why you must wear sunglasses when you go outside. Do not watch a solar eclipse. Even if you cannot see the sun, the harsh light is still there.
  - Only read in an upright position. Reading while lying down or in a car can be harmful to vision. Also do not read in the dark. To keep your vision safe you must read in well lit areas.
  - Also do not spend more than 20 minutes of time on a computer or phone. The screen’s light can be harmful to your vision.
  - Do not watch TV too close to the screen, this also has harmful light.
  - If you get dirt in your eyes, you must not rub your eyes. This can scratch the cornea and make your eyes irritated. Instead have an adult help you rinse your eyes out with water.
  - Conjunctivitis- This is a disease that can be caused when you do not wash your eyes. Bacteria will infect the mucus layer of your lids. The infection will cause redness to the white part of your eyes, itchy or burning eyes, tearing eyes, or blurred vision. When you have this you must go to an eye doctor to get treatment.

- **How to keep eyes healthy for good vision?**
  - Remember to always wear your sunglasses when going outside to play. If you are playing a dangerous sport, always wear a helmet. A head injury can be harmful to your vision
  - Eat healthy foods such as carrots, apples, sunflower seeds, fish, and spinach.
  - Go outside and play. You must take a break from your screens.
● **What are refractive errors?**
  ○ People who cannot see far away objects are called nearsighted. They have good vision for close up, but may struggle to see the board in school. If you struggle to see things in the distance, you may need glasses.
  ○ People who cannot see things close to them are called farsighted. They have good vision for far away but may struggle to see their phones, or paper they are writing on. Being farsighted also makes it difficult to read because the words are fuzzy. People who are farsighted need reading glasses, a special lens that magnifies things that are near.
  ○ People can also have astigmatism. This is when the eyes are a different shape. This makes the pictures that the eyes take blurry.

● **Why wear glasses?**
  ○ Wearing glasses can be important. If you have a vision issue, wearing glasses will correct it. It can make your life easier. If you are nearsighted, glasses can help you see the board. If you are farsighted glasses can help you read.
  ○ Although glasses make what you see clearer, it is important not to wear glasses if you don’t need them. If you have perfect visions, wearing a friend’s glasses can be harmful to your vision.

● **What do Eye Doctors do?**
  ○ Eye doctors prescribe glasses. They will test your vision in the distance and at near to see how well you see. They will tell you if you need glasses or not. If you visit an eye doctor and are told to buy glasses, trust them. They are trained professionals.

● **What are eye diseases?**
  ○ Retinal scotoma
    ■ Vision loss in one particular area, causing a blind spot in your vision.
  ○ Macular degeneration
    ■ Deterioration of the central portion of the retinal causing central vision loss
    ■ Caused by smoking, high blood pressure, obesity and genetic factors.
    ■ Prevention: avoid smoking and eat a healthy diet
    ■ Typically develops in adulthood.
  ○ Glaucoma
    ■ Increased pressure inside the eye. This leads to peripheral vision loss due to poor blood flow.
    ■ There can sometimes be insufficient drainage of the eye, caused by small tear ducts.
    ■ Glaucoma is a hereditary disease. You are at risk if a family member has it. See an eye doctor annually to monitor for symptoms of glaucoma.
Typically develops in adulthood.

- **Diabetic Retinopathy**
  - Damage to blood vessels of the retina leading to distorted vision.
  - Can only occur if you have diabetes, if you have diabetes you can prevent this disease by eating healthy and exercising regularly

- **Cataracts**
  - This is an unavoidable clouding of the lens caused by age.
  - This will cause blurred vision that cannot be corrected with glasses.
  - Occurs in adulthood
  - Can be treated with a simple surgery.

### How do blind people see?

- Blind people use canes to feel for objects around them. They use the cane to avoid walking into walls or falling down stairs. If you see someone suffering from blindness, you can help by offering to help him cross the street.

- Blind people use a special alphabet called braille, which contains patterns of bumps. Blind people will feel the bumps and know what letter they are touching. This allows them to read without seeing the letters in front of them
Supplementary Material 2: Activity Descriptions

Activity 1: Assemble the Eye

Students will be tasked with putting all of the parts of the eye in the right place. The correct completion of the eye will allow Desunik to see a hidden picture. This picture can be randomly selected based on a set of pictures designed for each age group. If they put a piece in the wrong place or forget a piece, Desunik will give them clues. (Example: they forget the retina, Desunik will say “the light is coming in the eye, but I am missing the part that converts light rays into chemical signals.”) The students will assemble the eye from the front to the back. As they do so the “light rays” will begin to enter the eye. (Example “the students place the cornea in the correct location and light enters but as a wide “blur”. The students then place an iris which contains the pupil and the “blur” of light is narrowed into a smaller cone. The students then place a lens which will focus the light onto a small point on the back of the eye. Next they will place the retina which will pick up the light rays and convert the light into an image which will then appear on the screen.) The game will not be limited to this order. Also, when students place the part of the eye in the correct location, Desunik will congratulate them and say “Yes the ‘eye part’ does ‘eye function’”

Activity 2: Colorblind Maze

The background will resemble the color blindness tests that optometrists use. The students will have to drag their finger along a line, which will be moving down the screen. While they move, there might be forks in the road where they can choose which way to go. They will pick up coins to collect points. These points can be used to purchase accessories for Desunik. If they run their finger off of the line, the game is over. The maze will change colors randomly to test for different types of color blindness. If a student goes off of the line for a specified amount of time (increases with increased difficulty level), the game will end and a message will ask them if they could see the line to follow. If they tap no, they will be told to talk to an adult about color blindness.

Activity 3: Convergence

The screen will show two different 2D images, which are slightly different. The students will have to line the images up to overlap in the correct area (just as the brain does with the two
images the eyes pick up). When the students line up the images, a 3D version of the image will be shown. Next, they will be given another set of images. There will be a timer and the students will have to try to converge as many images they can in the given amount of time. Difficulty can be increased by having some of the images be required to be rotated, or resized in order to overlap with each other.

**Activity 4: Decision Card Game**

A rogue-like card game where the player has to make different decisions to progress, similar to Reigns or Underhand. Every decision they make will change what resources they have available to them. They need to balance different resources to stay alive and do different things. The player is also tasked with objectives to complete during the game, giving the game a basis for the story, and a direction for the player to go. This type of game makes players consider the consequences of their actions, and how they affect both themselves, and others around them. We can use this game to have kids consider how they can make healthy decisions for their eyesight without having to explicitly tell them through the game.

In Reigns, the player plays as a king ruling over a country, they need to balance religion/piety, the happiness of the people, military power, and finances to successfully rule and complete objectives. Completing objectives will add new cards to the pile, opening up new possibilities and events.

In Underhand, the player plays as the leader of a cult trying to summon an eldritch monster/elder god. They need to balance their money, food, cultists, prisoners, and suspicion while trying to complete the objective. This game has a deck of events requiring the player to decide what they will need to stay alive, and complete their objective as it usually requires spending resources. When the deck is exhausted, it is reshuffled and they play through the cards again.

**Activity 5: Eyelash Dash**

Desunik will be on a side-scrolling map where there will be obstacles to avoid and maybe ladders or other fun things to interact with. Throughout the activity, there are different parts of the eye waiting on the ground or that possibly need to be unlocked. When they are picked up by Desunik, their corresponding function will be added to the game view. (For example, it may be slightly blurry to begin with, then they will pick up a lens that will make the game clear. Before they pick up the cones the screen could be in black and white.) At this point the game will pause and give a description of what part was picked up and why it is important. Throughout the activity there are dangers (such as scissors or cigarettes) for the eye that need to be avoided. When they are accidently picked up by the students a description will be given to explain why
the object is dangerous. When different obstacles are encountered or items are picked up, a popup will describe what is dangerous or beneficial and how it relates to your eyes.

Activity 6: Look Around the Room

Students will look through their camera at the room around them. They will be able to select “filters” which will distort the vision to represent different types of vision loss due to eye diseases. These filters will either blur out the peripheral or central vision for glaucoma and macular degeneration. The students will be given a description of the disease, what causes it, and what preventative measures can be taken so that they will know how to protect their eyes from the effects of this disease.

Activity 7: Matching

The students will match images with words. The students will then be timed to match all of the times as fast as possible. When the activity begins, the items are scattered about the screen. The students can then drag the items around. Matching items correctly will clear the matched items from the screen. Matching items incorrectly will resscatter the words.

Activity 8: Protect the Eye

The students will be placed in a scenario where Desunik’s eyes are in danger of getting dirt in them. The students will be tasked with placing the lids, lashes, and eyebrows in the correct location to start the game, then they must swipe and hit away dirt and dust before the dirt reaches Desunik’s eyes. If some does reach Desunik’s Eye it will get red and the screen will darken. They must use their finger to move the eye lids up and down to simulate blinking and flushing out the dirt in a safe manner. The first time they get something in their eye they will blink 5 times, next 10 times, finally 15 times. After three times of eye irritation, the next hit will result in the game ending.

Activity 9: Search and Find

Students will be presented with a picture that is relevant to their life (their home, a park, etc.) There will be a lot of different objects in the picture. From there, students will be given a prompt for the types of objects they need to find. For example, they could be asked “Find all things that are healthy for your eyes.” They would then look throughout the picture for objects that fit this
category. If they pick an object not in that category they will lose points. When objects are collected, they can be reviewed later to interact with and learn more about why they are healthy or harmful to the eye.

**Activity 10: Tilt Maze**

Students will roll a ball around a maze to get to the eye doctors office. Along the way they will encounter dangers, such as sticks, knives, dirt, sunlight, as well as good things like carrots, sunglasses and glasses. The bad items will slow them down and decrease their score, while the good items will speed them up and increase their score.

**Activity 11: Warioware**

The activity is a collection of simple micro-games. Players are given a random micro-game with a quick instruction, like Water, Sweep, Drop, etc. and need to complete it in time. If they clear the game, their score increases and they are given a new game. Every few games, the speed increases. Once they reach the fastest speed, the level increases (to a maximum of 3), increasing the difficulty of the micro-games. When the level advances, the speed resets to the slowest speed. The players are to aim for the highest score. A separate mode allows players to play individual games over and over again at every level, to practice the game so they don’t mess up on it, or just to last as long as they can with it.
# Supplement 3: Enjoyability Evaluation Checklist

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<tr>
<td>Colorblind Maze</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Eyelash Dash</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Search and Find</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Convergence</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Look Around the Room</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Decision Card Game</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Matching</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tilt Maze</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Warioware</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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</tbody>
</table>
Supplementary Material 4: Activity Educational Evaluations

Evaluation 1: Assemble the Eye

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description of Use</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Must Have</strong></td>
<td></td>
<td>-----</td>
<td>--------</td>
<td>------</td>
</tr>
<tr>
<td>Educational Pedagogy</td>
<td>Combine- students will have to recreate the anatomy of the eye to make it functional</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Student Motivation</td>
<td>Sounds of correct placement and feedback from Desunik’s well as the motivation to reveal the hidden picture.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Relevance</td>
<td>Make an eye to see an image of something they are familiar with or fond of such as famous buildings in Armenia or superheros for younger students</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Should Have</strong></td>
<td></td>
<td>-----</td>
<td>--------</td>
<td>------</td>
</tr>
<tr>
<td>Progress Tracking</td>
<td>A Badge can be awarded stating that they successfully assembled an eye.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Student Flexibility</td>
<td>Can be customized for each age group to have more or less parts to add</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Agency</td>
<td>Very short game they can complete in a small time with a phone</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Want to Have</strong></td>
<td></td>
<td>-----</td>
<td>--------</td>
<td>------</td>
</tr>
<tr>
<td>Collaboration</td>
<td>Compete with friends for better time</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Customization</td>
<td>While they can experiment with placing eye parts in different places, only the correct configuration will be accepted.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Evaluation 2: Color-Blind Maze

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description of Use</th>
<th>Low</th>
<th>Medium</th>
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</tr>
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<tbody>
<tr>
<td><strong>Must Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational Pedagogy</td>
<td>More of a screening for color blindness, yet uses understanding, as the students will better understand the meaning of color blindness and how colors are important to be distinguished</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student Motivation</td>
<td>Fun to solve the maze, get best times, more difficult mazes</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relevance</td>
<td>Can be made as a map from their house to fun locations like the park, school or famous buildings.</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Should Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progress Tracking</td>
<td>Earn a point for every second they stay on the line. If they go off the line for 2 seconds they lose 2 points</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student Flexibility</td>
<td>Mazes can get increasingly difficult, speed can change as well as different thicknesses of lines.</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agency</td>
<td>Mazes would be relatively short</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Want to Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>Compare Scores</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customization</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Evaluation 3: Convergence

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description of Use</th>
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<tbody>
<tr>
<td><strong>Must Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational Pedagogy</td>
<td>Create/Combine, also analyze- students are recreating what the brain does, and are combining two images, and must determine how the images overlap.</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Student Motivation</td>
<td>Student will try to converge as many images as possible, getting points for each image the successfully complete.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Relevance</td>
<td>Images will be relevant to Armenian culture, or super heroes, sports the children enjoy.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Should Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progress Tracking</td>
<td>Student can see old scores, as well as receive badges for mile stones such as completing 5, 10 or 15 images in one game.</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Student Flexibility</td>
<td>Students can start with just dragging images directly over each other, yet</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Agency</td>
<td>Short time limit will allow for shortened play time, such as 3 minutes</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Want to Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>Compare scores</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Customization</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Evaluation 4: Eyelash Dash

<table>
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<th>Description of Use</th>
<th>Low</th>
<th>Medium</th>
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<tbody>
<tr>
<td><strong>Must Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational Pedagogy</td>
<td>Classifying objects as harmful or safe/beneficial</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Student Motivation</td>
<td>Fun and competitive, can have larger points or rewards</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Relevance</td>
<td>Set in Yerevan</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Should Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progress Tracking</td>
<td>See best times, high scores, previous knowledge (notebook)</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Student Flexibility</td>
<td>Can be made easier or harder depending on things they encounter</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Agency</td>
<td>Should be relatively short levels, level can get harder but each will be able to be beaten in under 10 minutes</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Want to Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>Could compete for scores</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Customization</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
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</table>
### Evaluation 5: Look around the room

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description of Use</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
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<tbody>
<tr>
<td><strong>Must Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational Pedagogy</td>
<td>Students will understand the consequences of diseases, but won’t learn much about the disease itself.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Student Motivation</td>
<td>Fun and interesting to see how people see the world</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Relevance</td>
<td>Could be directly relevant to people they know with eye issues</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Should Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progress Tracking</td>
<td>Not really</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student Flexibility</td>
<td>Not much skill involved so good for all ages</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Agency</td>
<td>No time requirements, could be relatively quick</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Want to Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>Look through camera with others to see it</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Customization</td>
<td>Choose which disease to see</td>
<td></td>
<td></td>
<td>X</td>
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</table>
## Evaluation 6: Matching

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description of Use</th>
<th>Low</th>
<th>Medium</th>
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<tbody>
<tr>
<td><strong>Must Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational Pedagogy</td>
<td>Matching items/terms/concepts</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Student Motivation</td>
<td>The students can aim for the fastest time possible</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Relevance</td>
<td>Not really, it’s abstracted from real life</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Should Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progress Tracking</td>
<td>See best times, and correct matches made</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Student Flexibility</td>
<td>Multiple difficulty levels allow for different complexities of the items</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Agency</td>
<td>Relatively short games, allow it to be played in short sessions</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Want to Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>Could compete for the fastest time</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Customization</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Evaluation 7: Protect the Eye

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description of Use</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Must Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational Pedagogy</td>
<td>Student gains an understanding of protective eye parts and what to do when dirt gets in the eye</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Student Motivation</td>
<td>Points given for each correctly located protective part of the eye</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Relevance</td>
<td>They have eyes to protect, and play in dirt or experience eye irritation before.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Should Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progress Tracking</td>
<td>Scores based on time of how long they can go before the eye is too irritated.</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Student Flexibility</td>
<td>Based on the age group, the objects seen can vary from mud to pencils to allergens etc, as well as the speed and amount of incoming irritants</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Agency</td>
<td>Depending on how well they do, the game can last a few seconds or a few minutes.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Want to Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>Can share scores with other students</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Customization</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
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</table>
## Evaluation 8: Search and Find

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description of Use</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Must Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational Pedagogy</td>
<td>identify/ recall in optometry office, classify/order for safety</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Student Motivation</td>
<td>Student satisfaction when object is identified</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Relevance</td>
<td>Students will begin to get comfortable with the optometrist office</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Should Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progress Tracking</td>
<td>Students can keep track of how many objects they find</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Student Flexibility</td>
<td>Levels can start out easy with few objects in plain sight and progress to more well hidden objects</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Agency</td>
<td>Timers can be set so each level has to be completed in under 5 minutes. A few objects found quickly instead of 20+ objects that take awhile to find.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Want to Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customization</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Evaluation 9: Tilt Maze

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description of Use</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Must Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational Pedagogy</td>
<td>Classify, students will classify objects they encounter as safe or dangerous to their eyesight</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Student Motivation</td>
<td>Increase their score to get to the end, fun and engaging through motion</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Relevance</td>
<td>Ball will roll through scenarios of their life, like going to school, avoid sharp pencils, playing with friends, eating with family</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Should Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progress Tracking</td>
<td>Students can see their past scores and what good or bad things they hit</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Student Flexibility</td>
<td>Speed of ball can change to make it easier or harder, as well as descriptions of</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Agency</td>
<td>Levels can be made to be played within 3-5 minutes each.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Want to Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>Students can compete against their friends for high scores</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Customization</td>
<td>Choose colors and designs for their ball</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
### Evaluation 10: Decision Card Game

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description of Use</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Must Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational Pedagogy</td>
<td>Identify and recall eye safety precautions commonly encountered in daily life and apply them.</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Student Motivation</td>
<td>Progressing and unlocking new events</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Relevance</td>
<td>Based around everyday scenarios</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Should Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progress Tracking</td>
<td>Completing objectives, and opening new events</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Student Flexibility</td>
<td>Can have starting bonuses to help newer players, bonuses may include extra resources, or lighter punishments.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Agency</td>
<td>Play does not have to be continuous, the careful, decision-based gameplay allows for the app to be closed and resumed where it was left off.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Want to Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customization</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Evaluation 11: Warioware

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description of Use</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Must Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational Pedagogy</td>
<td>Can be used alongside lessons to reinforce information and show relevancy. Can also explicitly teach information.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Student Motivation</td>
<td>Aim for a high score, stories can be based around a level, play to unlock new micro-games, unlock new modes</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Relevance</td>
<td>Levels and stories can be based around the lessons taught and the real-world respectively. For example, a lesson on eye structure or eye parts can have microgames that make you assemble part of the eye, or match images with terms.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Should Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progress Tracking</td>
<td>See high scores, unlocked microgames, access to previous levels</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Student Flexibility</td>
<td>The game gets progressively harder and faster</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Agency</td>
<td>An average session of endless play lasts around 5-10 mins or so. Levels are shorter, being ~10-30 micro games.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Want to Have</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>Could compete for scores</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Customization</td>
<td>None</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
# Supplement 5: Features and Functions Evaluations

<table>
<thead>
<tr>
<th>Technology</th>
<th>Cost</th>
<th>Time</th>
<th>Use</th>
<th>Viable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accelerometer</td>
<td>$1000</td>
<td>~40 hrs</td>
<td>Measure non-gravitational acceleration</td>
<td>Yes</td>
</tr>
<tr>
<td>Gyroscope</td>
<td>$1000</td>
<td>~40 hrs</td>
<td>Measure orientation using Earth’s gravity</td>
<td>Yes</td>
</tr>
<tr>
<td>Eye Tracking</td>
<td>$5000(?)</td>
<td>Varies depending on solution</td>
<td>Identifies where the user is looking. Most applications use it for research purposes. Many require add-ons to work. Eyezag and umoove are 2 existing solutions, but eyezag is focused on research purposes, and umoove seems to have died.</td>
<td>No</td>
</tr>
<tr>
<td>Augmented Reality</td>
<td>$3750- $6250</td>
<td>~150-250 hrs</td>
<td>Interactive AR activities that take advantage of the user’s location.</td>
<td>No</td>
</tr>
<tr>
<td>Virtual Reality</td>
<td>$5000- $8000</td>
<td>1-6 months</td>
<td>Interactive VR activities that can show users something in a way not possible for a normal app.</td>
<td>No</td>
</tr>
<tr>
<td>Proximity Sensor</td>
<td>Unknown</td>
<td></td>
<td>The proximity sensor is used to detect how close someone is to their device. In many cases it is used to prevent accidental touches, but can also be used to facilitate touchless interactions.</td>
<td>Maybe</td>
</tr>
<tr>
<td>Speech Recognition</td>
<td>Free or Subscription-based, may be other options</td>
<td></td>
<td>Use speech to provide input, specify an action or command, or accomplish tasks.</td>
<td>Maybe</td>
</tr>
</tbody>
</table>

28
Supplement 6: Pre- and Post-Quizzes

Name: ________________________________

Ages 6-8

True or False: Circle T for True and F for False

T  F  It is dangerous for your vision to sit too close to a TV
T  F  It is important to wear sunglasses outside
T  F  You should rub your eyes hard if there is sand in them
T  F  Your eyebrows help keep dirt out

Identify the parts of the eye below: (word bank will be provided)

**Word Bank:**
1. Eyelid
2. Pupil
3. Iris

Circle parts of the eye that keep dirt out: Lids  Tears  Eyelashes  Lens  Eyebrow

Circle things that can hurt your vision:  Lasers  Dirt  Carrots  Knives  Sun
Name: _____________________________________
Ages 9-11
True or False: Circle T for True and F for False
T  F  Eating carrots helps you see better
T  F  It is important to wear sunglasses outside
T  F  An image is taken by your eyes, flip upside down, and then sent to the brain
T  F  You do not need to see an eye doctor regularly, only if you have a problem
T  F  Eating apples is bad for your vision
T  F  Everyone can see all the same colors correctly

Identify the parts of the eye below:

Word Bank:
1. Sclera
2. Pupil
3. Iris
4. Optic Nerve
5. Retina
6. Cornea
7. Vitreous Fluid
Name: __________________________________________
Age 12-14
True or False: Circle T for True and F for False

T  F  If you get dirt in your eye, try to rub it out with your hands
T  F  Your eyes pick up three distinct images which the brain uses to create depth.
T  F  Carrots are bad for your eyes.
T  F  Wearing glasses can correct blurry vision
T  F  Cones are a part of your eye that help you see color
T  F  You do not need to see an eye doctor regularly, only if you have a problem.

Identify the parts of the eye below: (word bank will be provided)

Word Bank:
1. Sclera
2. Pupil
3. Iris
4. Optic Nerve
5. Retina
6. Cornea
7. Vitreous Fluid
Supplement 7: Questionnaire

Name:___________________________________

<table>
<thead>
<tr>
<th>Question</th>
<th>Disagree</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I had fun!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would want to play this app with friends and family</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am going to take better care of my eyes after playing this game</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The game was easy to use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I learned new things about eyes through this game</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I learned about things that are dangerous to my eyes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would return to this game in the future</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I liked the app more than using a book</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have used <em>Desunik’s Game of Sight</em></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>I liked the app more than the book</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>1 Strongly Disagree</td>
<td>2 Disagree</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>---------------------</td>
<td>------------</td>
</tr>
<tr>
<td>I had fun!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would want to play this game with friends and family</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am going to take better care of my vision after playing this game</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The game was easy to use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I learned new things about eyes through this game</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I learned about things that are dangerous to my eyes and vision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would play this game again</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have used <em>Desunik’s Game of Sight</em> Book</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>I liked the app more than using a book</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Supplement 8: Raw data from progress evaluation

6 to 8

<table>
<thead>
<tr>
<th>Student</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
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<th>15</th>
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<td>Pre</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>11</td>
<td>7</td>
<td>11</td>
<td>16</td>
<td>6</td>
<td>10</td>
<td>13</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>Post</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>14</td>
<td>12</td>
<td>17</td>
<td>15</td>
<td>9</td>
<td>11</td>
<td>17</td>
<td>15</td>
<td>13</td>
<td>16</td>
<td>16</td>
<td>17</td>
</tr>
</tbody>
</table>

9 to 11

<table>
<thead>
<tr>
<th>Student</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>11</td>
<td>13</td>
<td>8</td>
<td>12</td>
<td>11</td>
<td>12</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>6</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Post</td>
<td>12</td>
<td>14</td>
<td>8</td>
<td>15</td>
<td>13</td>
<td>11</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>11</td>
<td>11</td>
<td>10</td>
<td>12</td>
<td>11</td>
<td>9</td>
</tr>
</tbody>
</table>

12 to 14

| Student | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|
| Pre     | 8 | 9 | 7 | 11| 8 | 8 | 6 | 5 | 6 | 7  | 4  | 5  | 6  | 6  | 7  | 8  |
| Post    | 11| 10| 11| 10| 11| 11| 9 | 9 | 11| 10 | 12 | 9  | 9  | 11 | 11 | 12 |
Supplement 9: Questionnaire Results

Ages 6 to 8

Ages 9-11

Ages 12-14
Supplement 10: Raw Observational Data

<table>
<thead>
<tr>
<th></th>
<th>Smiling/Laughing</th>
<th>Focused on Screen</th>
<th>Replaying Activity</th>
<th>Confused</th>
<th>Asking Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search and Find</td>
<td>16</td>
<td>52</td>
<td>22</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Colorblind Maze</td>
<td>23</td>
<td>47</td>
<td>51</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Protect the Eye</td>
<td>22</td>
<td>51</td>
<td>48</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Assemble the Eye</td>
<td>6</td>
<td>32</td>
<td>20</td>
<td>10</td>
<td>2</td>
</tr>
</tbody>
</table>
Supplement 11: Design Document

Design Documentation
For
Desunik’s Game of Sight

Prepared by:
Annalise Robidoux, Jared Grimm, Griffin Roth, Timothy Esworthy
1. Introduction

1.1. Overview and Need Statement

This document defines the requirements and goals of the Desunik’s Game of Sight Mobile Application. It outlines the purpose, structure, system requirements, features and design of the app for both developers and the Armenian Eyecare Project (AECP).

Desunik’s Game of Sight is a successful book that educates children ages 8 through 10 on eyecare, eye safety, and eye function. The AECP wishes to expand the target age range as well as spread the knowledge of eyecare to a global audience of children. The Desunik’s Game of Sight App was designed as a supplement to the current AECP booklets and board game, in order to reach a larger age range and present eyecare information to children in an engaging way. The app combines educational video lessons and games to provide an interactive learning environment. While the app currently only covers eyecare, we believe this style and structure of gameplay can be used to educate about other health related topics. It can also be translated for use all around the world.

1.2. Project Goal

The main goal of this project is as follows:

Create a fun and engaging application to educate children between the ages of 6-14 on eyecare, eye safety, eye function, eye diseases, and eye health.

1.3. Scope

The application will include short video lectures, in depth educational games that reinforce the lessons as children play, and fun minigames. Currently the app is only focused on educating through games, however, the scope could be expanded in future iterations to also incorporate technology such as Augmented Reality (AR) or Virtual Reality (VR).

1.4. Assumptions

In providing the following recommendations, we did so with the following assumptions:

- The app will be split into three age ranges, 6-8, 9-11 and 12-14 years old
- The app will not require internet during play
- More activities than those described in this document can be added.

1.5. Current Results

We created mock-ups of four of our proposed activities as well as the associated educational videos. These were then tested at three schools around Yerevan.

The four activities we mocked-up and tested are:

A. Assemble The Eye
B. Protect Desunik’s Eye
C. Colorblind Maze
D. Search and Find
These activities were relatively basic compared to the expected level of quality for the final app.

To test our activities, we visited three schools where we met separately with three groups of six students from each age range. We began with a pre-quiz, played an educational video, let the students play with the app, then finished with a post-quiz and enjoyability questionnaire. The quizzes let us assess the learning potential of the app, and the questionnaire and observations let us assess how much fun the children had with the app.

Below are our results from our tests, surveys, and observations:*included in full document but not repeated in supplement

Pre and post-quiz scores demonstrate that most students showed substantial improvement in their knowledge of eye anatomy, care, and health.

Below are our Survey results by age group: *included in full document but not repeated in the supplement

Children ages 6-8 thoroughly enjoyed the games, yet found some a little challenging to use. They were all laughing, cheering, replaying games, and often wanted to keep playing after time was up.

Children ages 9-11 also responded that they had fun. They all learned a lot of information. The students who said they did not learn dangerous things, had a near perfect score on their quizzes, so there was little for them to learn from the mock-up. Some games were still slightly difficult for the children. There was collaboration and competition between students to see who could perform best on the games.
Children 12-14 really enjoyed the activity and felt that they learned something new. The majority of them would return to the game in the future. Although they were more mature, these students still enjoyed the competitive games and thought the sounds, art style, and gameplay were enjoyable.

From these observations we found a few things to change for the app:

- Difficulty levels should vary much more for each age group
- Not all children were proficient enough at reading in the 6-8 group to fully understand written instructions
  - Simple instructional graphics would be beneficial
- Overall all games were well received, although “Assemble the Eye” was the least popular of the four. This may be because it focused so heavily on education.
- For older age groups, challenging games that require more skill are the most fun.
2. General Design Constraints

2.1. Product Environment

We recommend that the application be designed for cross platform use. Android phones are the most common in Armenia and therefore development for the Android platform should be prioritized. Following Android development, an app for Apple devices would also be beneficial. Beyond phones, adding in support for computer use may be useful for schools.

We recommend utilizing Unity Game Engine to develop such games, as it allows for realistic physics, collisions, and development across all platforms in both 2D and 3D. It also has extensive user libraries and add-ons. While recommended, using Unity Engine is not a requirement.

2.2. User Characteristics

Our application will cater to a wide audience with varying ages. We have broken the age range into three groups: 6-8 year olds, 9-11 year olds, and 12-14 year olds.

From our testing in schools, we determined that these ranges effectively separated children into groups with similar abilities and learning potential.

For the 6-8 year olds, we found that a lot of text had to be explained verbally, so it would be beneficial to use simple words and sentences and a lot of graphics. They also found some of the games to be difficult, so creating very simple games would allow them to have more fun.

9-11 year olds are better with complex text and longer sentences, but still found some activities to be too challenging. Having a variety of difficulties would also benefit this age range.

12-14 year olds had no trouble with text and long words and picked up on the activities very quickly. We found that some activities were too basic for this group, so more complex levels would be ideal. Additionally, we found this group to be more excited to learn and activities that teach detailed information are well received with this group.

2.3. Client Constraints

Our recommendations stay within the following constraints from the AECP:

- Include the original character of Desunik.
- Follow the design and art style from the book.
  - The app must be easily recognizable as a supplement to the app
- Individual games must be designed to be played within 5 - 15 minute time frames, as access to devices for children may be limited.
- The app should be completed with a budget of around $10,000 and in no way exceed $15,000.
- Development must remain in Armenia.

2.4. Potential System Evolution

The application has the potential to be translated and customized for use all around the world, as well as expanded to further age ranges in the future. The application could also be integrated with medical
records and APIs to use the phone camera to screen for eye issues such that parents could screen their children at home.

This application and structure of using videos and games to educate children could also be adapted to other fields of health care such as diabetes.

3. Nonfunctional Requirements
Nonfunctional requirements are properties the system that does not incorporate in the games or videos, but affect the underlying technology and usability.

Aside from recommended requirements, the app should meet the Google Play Requirements for deployment found here https://play.google.com/about/developer-content-policy/#modal_active=none

3.1. Usability Requirements
The application is designed for children aged 6-14. Students should be able to select their ages at the start of interacting with the app. The app should change to reflect the selected age group of the user.
For children 6-8: Simple sentences and words. Increased use of graphical explanations.
For children 9-11: Varying difficulties to encourage replayability.
For children 12-14: More complex games and knowledge to transfer

3.2. Operational Requirements
The app’s main use case will be on a mobile device to provide short play times of around 5-20 minutes. It is likely that the phone will belong to the parent of the user so shortened use time will allow for the short play time allowed by the parent.

Some activities can be designed for mobile phone using accelerometer and gyroscope functions, then modified for the computer, where such technologies are not available. As a result, some activities included in the mobile version may not be included or will need to be heavily modified in a future computer/smartboard version.

3.3. Performance Requirements
System startup time should be less than 3 seconds. No operation should take more than 5 seconds and 95% of the operations should take less than 2 seconds. Videos should be pre loaded, or embedded so that no internet is needed to view them. Game play should not fall below 30 frames per second. The app should avoid race conditions and have all caught exceptions lead to a safe exit of the game.

3.4. Safety Requirements
As this is an application aimed at preventing childhood eye damage, the application should be vision friendly. To do this, a built in blue-light filter should be applied over the entire app to reduce the strain on the eyes. Also, the app should not allow more than 40 minutes of play per
day. If used for 20 consecutive minutes, a message prompting the children to “Go outside and play! Remember your sunglasses.”

3.5. Security Requirements

A save-file to save player progress locally on a device should be made. While no sensitive data currently exists in the app, passwords should be encrypted. Initialize all parameters on startup to avoid start-up attacks. The app should not record or forward any sensor data. If future iterations involve taking pictures for eye scanning, the user must accept the new app permissions, and camera should only be open during eye screening. The app should not include cookies or tracking devices. The app should not interact with any other applications or files of the device. The app should not contain hard coded references to external resources, such as the videos, as the external resources may be breached by attackers.

3.6. Legal Requirements

The characters and design of the *Desunik’s Game of Sight* book are copyrighted by the AECP. Permission for the use of characters and elements from the book should be attained. Additionally, a copyright notice should be prominently displayed somewhere in the app. If future iterations include medical records such as scans for the eyes, proper security must be in place so children or others cannot view each other’s medical records.

3.7. Deployment

The game should be able to be transferred to a flash drive or CD to take to schools to install where internet may not be available. As mentioned before, the app should run without connection to internet. The app should still be hosted on the App/Play Store to be downloaded as well.

3.8. User Interface

The color scheme and design elements should be based on the *Desunik’s Game of Sight* Book, and the icon of the app should feature the character of Desunik. This provides a familiar and trusted character which students already know and enjoy. A mood board has been provided below to show sample characters, fonts, buttons and backgrounds.
Desunik's Game of Sight

App Design
Sample Button

Character Design
4. Gameplay Structure

The way in which students will interact with the app is outlined here. Students will enter the app. After signing in and selecting their age range for the first time, students will be brought to the main home page, where they can choose to “LEARN” or “PLAY.”

The user will be brought to a list of 12 lessons with icons that represent each topic:

- What is vision / sight?
- What are your eyes?
- What are the parts of your eyes?
- How do your eyes work?
  - Light inversion
  - Colors / color blindness
  - Depth perception / convergence
- What are dangers to your vision?
- How to keep eyes healthy for good vision?
- What are refractive errors?
- Why wear glasses?
- What do eye doctors do?
- What are eye diseases?
- How to protect your eyes from injuries/what to do if you injure your eye?
- How do blind people read?
  - Brail/white cane

A detailed list of information for these lessons is provided in section 12 of this document.

After selecting a video, students will:
1. Watch a video explaining the lesson in-depth, with a voiceover and text captions and an animated character (1-2 min max length)
2. Play an informational game that explains or reinforces information presented from the video as they go
3. Answer a multiple choice question to show knowledge gained during the lesson.
   a. There will be four answers to choose from, with only one correct answer.
   b. The student must answer correctly to unlock play.
   c. If answered incorrectly, an explanation for why the answer is incorrect is provided. The student then must attempt the question again until they answer it correctly.
4. Completing a lesson unlocks a badge stating they mastered that lesson
5. Students can then click Play from the home screen, and play fast-paced minigames, that involve concepts from the lesson that unlocked that section.
6. They will have to go back and complete another lesson in the learn section in order to unlock more fun minigames.
This style of learning with small fun games, motivates the students to return to the app and continue to progress through the lessons in order to be able to play more games.

Structured Use Case

Tim is a new user and opens the app for the first time. He sees ‘learn and play’ and obviously wants to play games. He goes to tap on the PLAY button, but notices it is grayed out. A prompt displays where he is told he must learn before he can play games. He must first click the learn button, where Lesson 1 “What is vision” is highlighted. He taps the lesson and Desunik says both in sound and a text popup: “Great, lets learn about vision!” Then a video explaining vision plays. Upon finishing the video, Desunik asks Tim if he is ready to play a game about vision. Then an educational game such as Assemble the Eye, is played. Once Tim has finished the game, he is asked a multiple choice question. When the question is answered correctly, he is able to move on to the next lesson where he can unlock a different game.
5. Activities
   We designed and selected activities based on educational criteria. *full activity descriptions in full document but not repeated in supplementary material*

5.1. Assemble the eye

   **Overview**
   - 2D (potentially 3D) puzzle game where the player puts together the pieces of the eye.
   - 1 Player
   - Initial playtime: 3-5 mins (future playthroughs will likely be shorter)
   - The intention is to be a simple, slow-paced game that students play after a video.

   **Gameplay Mechanics**
   1. The player is presented with the outline of an eye. They will be prompted to place a certain part of the eye in the correct place.
   2. 3-4 parts are shown at a time, with 1 part being the correct part for the prompt.
   3. The player must drag the correct part to the correct place
   4. If the wrong part is placed, return the part to its original position, and give the player a hint for the correct part.
   5. If the correct part is placed in the wrong position, tell the player the part does not go there, and to try again.
   6. When the correct part is placed, Replace the part in the bank with a new part, and choose a new part from the bank for the prompt.
   7. Players should be given hints using recorded audio of Desunik giving them the hint.
   8. When all the parts have been placed, spin the eye around to show a random picture of some kind.
   9. The player should be timed for how long it takes for them to complete the puzzle, with high scores being recorded.
Gameplay Modes
There are two modes:

- **Parts Mode**
  - Instructs the player to place pieces of the eye by part name. Ex: “Place the Sclera”
  - If the player places the wrong part, they are given a hint for what the correct part may be by their function.

- **Function Mode**
  - Instructs the player to place pieces of the eye by their function. Ex: “Place the Sclera”
  - If the player places the wrong part, they are given a hint for what the correct part may be by part name

Difficulty Options
Since the app will be for different age groups, difficulty must be tuned accordingly for each group.

- **For 6-8:** Focus on the front of the eye, with parts such as eyelashes, eyebrows, pupils, etc.
- **For 9-11:** Some of the parts inside of the eye should be represented. Parts such as the cornea, lens, retina, etc.
- **For 12-14:** All or most of the parts of the insides of the eye should be represented. Parts include the zonules, macula, conjunctiva, etc.

Audiovisual Components
- Appropriate background music should be played throughout the activity, with unique tracks for playing the game, and after completion.
- Sound effects should include picking up pieces, placing pieces, getting pieces wrong, etc.
If the player gets a piece wrong, an voiced audio clip should play of Desunik giving the player a hint.

The reward picture should be something the children can connect with, perhaps depicting an activity in their life. Alternatively, the picture can be a short animation of some activity. Either way, the reward image should be in the style of Desunik’s Game of Sight.

5.2. Color-Blind Maze
5.3. Convergence Activity
5.4. Search and Find

Phone Technologies Used
- Tap and drag
- 360 Images

Environment
- The levels for eye safety and eye health can take place in supermarkets, houses, schools, outdoors.
- The Eye Doctor visit will take place in an office similar to an optometrists office, showing the typical equipment and charts to familiarize the children with the environment.

Game Strategy
- The player wants to find all the objects as quickly as possible without selecting incorrect objects, or running past the allotted time.
- The game will be based on tapping objects, and pressing and holding to move and look around 360 environments. The Words/objects will be shown on a scrolling bar on the left hand side of the screen.
- The player will earn 10 points for each object found and lose 5 points for each incorrect object tapped. Score starts at 0

Levels/Difficulty
- There are three main Difficulties the students can select, which are outlined in the state diagram below.
- Difficulty will also be based on the students age:
- For students 6-8, a silhouette of the objects as well as their names will be shown on the left hand side of the screen.
- For 9-11, only the names of objects will be shown.
- For 12-14, No names or images will be shown, rather simply a clue of “Find all of the items good for/dangerous to your eyes” will be shown

**Audiovisuals**
- Background music will play throughout the game
- When 30 Seconds remain, a clock-tick will also start playing
- When a correct object is found, a bright ding sound will play, with a green +10 shown by the score
- When an incorrect object is clicked, a dull buzzer sound will play, and a red -5 will be shown by the score.

**AR Specification/ Future features**
- Future iterations could include an AR Version that Scans a room, and hides the objects around a real physical room. The player than moves the phone around looking for and tapping on the objects. The score, levels and game strategies would remain the same.
5.5. Eyelash Dash

**Environment**
- The game will feature dynamic background imagery and Asset textures. They will start out resembling Yerevan city, and as Desunik runs further, the backgrounds will transition to other regions from Armenia, roughly every 30 seconds. The game will be 2D, and the Desunik should run from the left of the screen to the right. Similar to games such as Mario, The floor will have holes, where Desunik must avoid falling, or small obstacles she must jump over. There will also be platforms above Desunik, that she can jump up to.

**The Physics**
Desunik’s main abilities will be to jump up, crouch down
- Jumping will result in Desunik’s Y position increasing by a factor of 2X her height, and should be able to land on every platform
- Crouching decreases Desunik’s height in half, so she can run under platforms.
- In the X Direction, Desunik will be able to move both left or right. The camera should be centered on Desunik.
- Double Tapping the left or right directional buttons will result in Desunik moving faster in that direction.

**Game strategies, resources, health (limited or unlimited)**
- Desunik must collect all the Parts of the eye and reach the end of the level, which will be marked by an AECP mobile eyecare truck.
• Her health will be measured by 3 images of her face. Everytime she hits a sharp object, she loses one item of health. She can regain health by picking up carrots that are randomly dispersed at a low rate, (1 every 20-30 seconds).
• There will also be Black boxes that represent Eye diseases. When Desunik hits one of these, it does not lower her health, but rather alters the Environment of the game. Some diseases will make the game blurry, others will narrow the field of vision by adding a vignette to the sides, or covering the screen in black spots.

Controls, HUD display
• Desunik will be controlled by touch controls displayed on the screen.
• Directional buttons for left and right will be on the bottom left of the screen, and will be two buttons, that will alter Desunik’s X position by tapping on each button. On the right side of the screen, will be the up and down arrows that will control jumping and crouching.

Assets
Items needed will be:
• Desunik
• A token representing each of the 4/5 eye diseases
• A token representing each the 5 Part of the eye to collect
• Carrots

Levels, progression
• Have 5 different levels, where each of the eye parts is a different level to alter the game environment, and progresses from a dark colorless blurry game, into a bright colorful clear game in the last level.
• Each level has more dangers and diseases. 1 disease pops up in the first level a few times. Then in each sequential level, more are added until all 5 diseases appear in the last level.

Audiovisuals
• Background music will play throughout the whole game.
• Bright ding Sounds when collet an eye part
• Splatter sound when hit a sharp object
• Dark scary sound when hit a disease

Collisions
• Collisions will occur between Desunik and the parts of the eyes, diseases, as well as dangerous objects, including scissors. When collecting a part or disease, Desunik will
remain in motion. When hitting a sharp object, she will stop, and her character will flash and show signs of injury.

5.6. Look Around the Room
5.7. Protect Desunik’s Eye

6. Videos

The educational videos created for each section will pull information from the provided knowledge to transfer for each lesson. While information has already been broken up by age, the AECP can assist with finalizing the content of each video. They can also choose to either record the audio themselves to save cost or outsource the production.

The videos will composed of audio of the read scripts, alongside animated content. In the mockup testing, we utilized Powerpoint to animate Desunik and display content for the video. The final product should be much more robust and professional than Powerpoint.

In order to reduce memory usage for storage of the application, the videos can be procedurally generated in engine during runtime. Only the smaller mp3 files will have to be stored in the game. When they are played, Desunik can be animated alongside the audio to simulate a movie. This will need more development time, and increase cost slightly, yet cut down on size and load time.

If internet connectivity should be avoided, the videos will all have to be loaded into the game. However if connection to the internet is available for enough users, videos can be stored in online, and only the first 3 videos for each age group can be embedded into the game. The rest will be hosted on a server (which also may increase costs starting from $50 annually) and users will stream the videos from the server.
7. Features

Below are features beyond the gameplay and activities of the app. Each feature has a description and is marked by its cost, risk and value. An overview of baseline additional requirements is also listed.

7.1. Feature: Customizing Desunik

**Description and Priority**

- Students should be given the ability to customize their character. Customizations should include:
  - Gender
  - Height
  - Hair
  - Eye Color
  - Shirt Color
  - Pants Color
  - Different styles and Colors of Glasses

**Cost:** Low  
**Risk:** Low  
**Value:** High

**Additional Requirements:**  
None

7.2. Feature: Badges

**Description and Priority**

- Upon completing lessons and challenges with certain scores for games, students can unlock badges.

**Cost:** Low  
**Risk:** Low  
**Value:** High

**Additional Requirements:**  
Database holding badges with flags for whether or not the badges are unlocked.

7.3. Feature: High Scores

**Description and Priority**

- Save the players highest scores for each played game locally on the device. They can be displayed on each game as to compare their current score with their
all-time high score, as well as a page of just high scores for each game can be displayed in the same area as the badges for the game.

**Cost:** Low  
**Risk:** Low  
**Value:** High

**Additional Requirements**  
Backend database to hold top scores by player on each game.

---

7.4. Feature: Timer Lockout

**Description and Priority**  
- Timer to lock the student out of the game after 20 minutes of straight play time.  
  Upon being locked out, the student can not re-access the app for 8 hours, such as once before school and once after school.

**Cost:** Low  
**Risk:** Low  
**Value:** High

**Additional Requirements**  
Timer that starts upon app launch. When Timer reaches 20 minutes, display a screen prompting children to go outside and play. Lock touch input and close the app after 2 minutes. Start another timer after lockout that disables the launch of the app for 12 hours. If they try and Launch the app during this time, display a message saying “Too much play time can be harmful to your eyes, enjoy the world around you for “Insert Time remaining until app is enabled*”
8. **Summary of Minimum Viable Product**

The Minimum Viable Product (MVP) is the minimal features, games, and lessons which will satisfy the project goal and needs of the AECP.

The MVP should accomplish the goal of educating children ages 6-14 on eyecare, eye health, eye function, and eye safety.

The MVP should be composed of:
- An application to educate children through videos and games on eyecare, health, safety, diseases, and functions on a mobile app platform.
- Activities and deployment should be able to be played with no internet connectivity.
- 12 videos - one for each of the mentioned lessons
- 2-3 Extremely well built educational games, we recommend Assemble the Eye, Search and Find and Eyelash Dash. Showing the app to be successful with these games can help solicit funding for more features and games later on.
  - Activities mentioned above can be modified to be used for more than one topic of eye knowledge.
  - More activities can be added, however at a minimum the previously mentioned activities should be included.
  - Activities were named in English, if more suitable Armenian names, that are catchy, rhyme, or make sense to the children can be found, please use them.
  - If budget allows, 12 educational games (one per lesson), utilizing the 7 activities mentioned above, can be included in the MVP. But should be implemented eventually.
- Follow the design of the Booklet
- Include the characters and art design of *Desunik’s Game of Sight*

9. **Future Iterations and Features**

Future iterations of the app may exist on cross platform devices, like computers, phones, smartboards, and tablets. Future iterations can contain activities that utilize or require internet connectivity to have students play with or against each other.

9.1. **Feature: Usage Statistics**

**Description and Priority**
- Collect background statistics on number of downloads, duration of use, frequency the app is opened, progression of how far students are in lessons, and which games are played most often.

**Cost:** Medium  
**Risk:** Low  
**Value:** Medium
Additional Requirements
Backend database to store statistics and would require internet connectivity to send back information to developers/AECP.

9.2. Feature: Cross-Platform Database and Integration

Description and Priority
● Students will be able to log in to the app, complete a game and earn a badge, then log into the computer application and continue with the progress and badges they had on their phone.

Cost: Medium
Risk: Medium
Value: Medium

Additional Requirements
Internet connectivity, server holding database of statistics to be accessed by any device.

9.3. Feature: Refractor Error Camera Screening

Description and Priority
● Utilize the phones camera flash to look for refractive errors in the eyes to screen children anywhere. Whether remade or use existing APIs from companies like GoCheckKids: https://www.gocheckkids.com/

Cost: High
Risk: Medium
Value: High

Additional Requirements
Possible phone hardware, camera permissions for the app

9.4. Feature: Static Glasses Trial

Description and Priority
● Students upload or take a picture of themselves, and can drag various pairs of glasses over their face, utilizing artificial intelligence to map it over their eyes and nose.

Cost: Medium
Risk: Medium
Value: Medium

Additional Requirements
Camera/storage access, Artificial Intelligence algorithm to analyse face structures.
9.5. Feature: Augmented Reality Glasses Trial

**Description and Priority**
- Utilizing face mapping on iOS devices, have the ability to try on different styles of eyeglasses. Example of current Warby Parker App shown here [https://bit.ly/2Ir2Uvr](https://bit.ly/2Ir2Uvr)

**Cost:** High  
**Risk:** High  
**Value:** Medium

**Additional Requirements**
Face mapping technologies, AR environment, or utilize existing APIs
## Supplement 12: App Developer Evaluations

**Developer 1: X-Tech**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Unsatisfactory</th>
<th>Satisfactory</th>
<th>Exceptional</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Portfolio/Past Works</strong></td>
<td>How do their past works align with our vision of a children's mobile app</td>
<td></td>
<td>Presentation of past works, several video demos, and live AR demo. Several Educational apps and apps for social causes or to raise awareness (solar, art, animals)</td>
</tr>
<tr>
<td><strong>Formal Development Process</strong></td>
<td>Does the company follow the Waterfall SDLC, or Agile, or no formal style.</td>
<td></td>
<td>They use Agile with two week iterations, and can range from 2 months to 6 months on projects.</td>
</tr>
<tr>
<td><strong>Office and Staff</strong></td>
<td>Is the office professional and allow productive communication. Are the staff friendly and communicate well with clients.</td>
<td></td>
<td>Very modern space, lounging area with bean bags, Open desks next to each other, collaborative spaces, whiteboards. friendly and enjoy doing social work.</td>
</tr>
<tr>
<td><strong>Credibility of Company</strong></td>
<td>How many projects have they completed, and user satisfaction</td>
<td></td>
<td>Company has been around for 10 years, won awards and competitions for Flash Websites. Makes web, Kinect, and mobile games, for dozens of global organizations</td>
</tr>
<tr>
<td><strong>Quality of Quote</strong></td>
<td>Is the quote of their expected work detailed, and organized</td>
<td>No quote was given, just possible ideas</td>
<td></td>
</tr>
<tr>
<td><strong>Expected Cost</strong></td>
<td></td>
<td>No expected price or price points given</td>
<td></td>
</tr>
<tr>
<td><strong>Expected Timeline</strong></td>
<td></td>
<td>Were not able to provide an expected timeline</td>
<td></td>
</tr>
<tr>
<td><strong>Notes</strong></td>
<td>Do several similar projects such as teaching children how to take care of trees, or promoting the use of solar power. Use the Unity platform, especially for AR/VR. Extremely set on AR solutions.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Some solutions involve just a surface like a floor, others can be built off of the existing book to “Bring it to life”
However they agreed that AR is not available to most Armenians in other regions.

They understand and like the structure of our app. Would like to know more of the specific game mechanics.

Wants to include the game inside of Arloopa (their child companies AR platform) This would save money however the app would not be a standalone game and only available to those who download Arloopa.
### Developer 2: Vectual

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Unsatisfactory</th>
<th>Satisfactory</th>
<th>Exceptional</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Portfolio/Past Works</strong></td>
<td></td>
<td>While none were shown to us, 50 applications in Unity have been made. 20 with AR</td>
<td></td>
</tr>
<tr>
<td>How do their past works align with our vision of a children's mobile app</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Formal Development Process</strong></td>
<td></td>
<td></td>
<td>Agile, 1 week iterations, must get approval from client</td>
</tr>
<tr>
<td>Does the company follow the Waterfall SDLC, or Agile, or no formal style. Agile is preferred</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Office and Staff</strong></td>
<td></td>
<td>12 Employees in office, clean environment, good collaboration. Owner was slightly awkward to talk to. Rest of staff very friendly.</td>
<td></td>
</tr>
<tr>
<td>Is the office professional and allow productive communication. Are the staff friendly and communicate well with clients.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Credibility of Company</strong></td>
<td></td>
<td></td>
<td>15 years old, child of a larger French Company, mainly focused on architecture and mapping</td>
</tr>
<tr>
<td>How many projects have they completed, and user satisfaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Quality of Quote</strong></td>
<td></td>
<td>No quote was given, just time estimates</td>
<td></td>
</tr>
<tr>
<td>Is the quote of their expected work detailed, and organized</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Expected Cost</strong></td>
<td></td>
<td>“Within $10,000 will be fine”</td>
<td></td>
</tr>
<tr>
<td><strong>Expected Timeline</strong></td>
<td></td>
<td>2 months depending on approval times from AECP</td>
<td></td>
</tr>
<tr>
<td><strong>Notes</strong></td>
<td></td>
<td>We settled on developing for Android and iOS, however he had concerns with regards to the videos in the app, mainly how they would largely inflate the size of the app.</td>
<td></td>
</tr>
</tbody>
</table>
## Developer 3: Alex

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Unsatisfactory</th>
<th>Satisfactory</th>
<th>Exceptional</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Portfolio/Past Works</strong></td>
<td>How do their past works align with our vision of a children's mobile app</td>
<td>Only game made has been poker. Very good App that helps parents track children vitamin d intake, UV scanner. Experience with web, mobile and virtual reality development.</td>
<td>Gathers data and, wire frame of all screens with user flows. Must be approved by client before development starts. kanban which is a subset of Agile, uses 2 week sprints.</td>
</tr>
<tr>
<td><strong>Formal Development Process</strong></td>
<td>Does the company follow the Waterfall SDLC, or Agile, or no formal style. Agile is preferred</td>
<td>Work from home, Alex was very professional, a project manager for other companies, has best business and design ideas in mind</td>
<td></td>
</tr>
<tr>
<td><strong>Office and Staff</strong></td>
<td>Is the office professional and allow productive communication. Are the staff friendly and communicate well with clients.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Credibility of Company</strong></td>
<td>How many projects have they completed, and user satisfaction</td>
<td>No formal company, Freelance designers who contract developers. Mentioned a case when a project took double the expected time.</td>
<td></td>
</tr>
<tr>
<td><strong>Quality of Quote</strong></td>
<td>Is the quote of their expected work detailed, and organized</td>
<td>Detailed description of time and cost estimates. They have a strong upper level management, but the contracting of developers is worrisome</td>
<td></td>
</tr>
<tr>
<td><strong>Expected Cost</strong></td>
<td>Design would be $3500, Development for iOS and Android would be $8000, just</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Expected Timeline** | 2-6 months, free to start after April
---|---
**Notes** | Make apps natively, without game engines such as unity. Agrees Unity may be best but does not have experience with it.  
Alex, 2 friends, digital design company, user experience, mobile and web  
Been around for 10 years. Main designers work for picsart, vmware, US based company based on cryptocurrency. Alex is a project manager in UI/UX.  
No staff, office, project base on demand, network of 100 people, from wherever.  
Important to stress that Parents make the decisions for kids, so content catered to parents should be included  
Watchable content

Android would be $4,000
Supplement 13: Prospectus Sides

Armenian EyeCare Project
Bringing Sight to Armenian Eyes

The Armenian EyeCare Project is a 501(c)(3) nonprofit organization with offices located in Newport Beach, California and Yerevan, Armenia.

The Armenian EyeCare Project follows a five point strategy to address their goal of eliminating preventable blindness in Armenia and making quality eye care accessible to everyone in the country...
1. Direct Patient Care
2. Medical Education and Training
3. Public Education
4. Research
5. Capacity Building
Armenian children suffer higher rates of strabismus, glaucoma, diabetic retinopathy, inflammatory diseases, and retinal disorders. The AECP provides annual screenings in schools as part of their early intervention efforts.

Knowledge of eye care is provided to children through multiple public education lessons and their children’s book: Desunik’s Game of Sight. AECP promotes healthy behaviors through childhood education.

The AECP’s Mobile Eye Hospital services 35,000 Armenians in villages outside of Yerevan each year and has housed roughly 11,000 surgeries.

**Desunik’s Game of Sight** is a book of extra curricular lesson plans for third graders.

- Print 3,000 copies each year at a cost of $1.50 per book
- Approved by the Armenian Ministry of Education and Science
- Distributed free with lessons plans to teachers
- Comprehensively teaches eye anatomy, health, safety, function, and care
- Completely funded by donors, mainly diaspora
Benefits of a Mobile Application

- **Cost:** An app is a one time cost, unlike the book printed annually.

- **Improved Learning:** Learning though a mobile application engages students more, leading to increased retention and motivation.

- **Broader Age Range:** The book currently targets ages 8-11 where the app accommodates for ages 6-14 with adaptable activities.

- **Extended Learning Environment:** The book is designed for use in schools where the app can extend beyond the classroom.

- **Better Use of Phone Time:** Children play games anyway. This app will make that time educational instead of a waste of time.

- **Eyecare is a Global Issue:** By 2050, half of the world will have a vision related issue. Education can reduce these preventable blindesses.

- **Potential for Global Impact:** This educational format can be translated into multiple languages and adapted for multiple health care areas.

---

Digital Supplement Design/Vision

The digital supplement will compliment the design of the *Desunk's Game of Sight* booklet.

Male characters and characters of different ages will also be included in the design.

Characters will be customizable by the students.
Application Structure

- Students will be given the option to learn or play.
- Games will not be unlocked until associated lessons are completed.
- Games are intended to reinforce the knowledge taught in lessons.

Select Your Age.

Choose if You Want to Learn or Play

Learn

Select a Lesson

Watch a Video

Play an Educational Game

Pass a Multiple Choice Question

Students reacted positively to a mock-up application.

- All students learned new things about their eyes
- Most had fun and would play again

52 Students

Would Play Again (99%)  Learned Dangers to Their Eyes (94%)
Had Fun (96%)  Learned New Things About Their Eyes (100%)
The mock-up version of the app was also educationally valuable; students who played the activities showed knowledge-growth through pre and post play-time quizzes. The majority of students had higher post-quiz scores than pre-quiz scores displaying some degree of knowledge retention.

**The System Development Life Cycle has already been started.**
Steps one, two, and three have been completed by four undergraduate students from Worcester Polytechnic Institute:

- **Tim Esworthy**, Mechanical Engineering
- **Jared Grimm**, Computer Science
- **Annalise Robidoux**, Biology/Biotechnology & Chemistry/Biochemistry
- **Griffin Roth**, Robotics Engineering

**Next steps:** Hire a developer and determine cost/timeline.
Thank You!
Supplement 14: Recommendation Document

Recommendations
For Development & Implementation
of
Desunik’s Game of Sight
1. Developer Recommendations

Vectual is most qualified to implement the app for the AECP. Vectual has the tools, business organization, professionalism, and experience to complete this project within our specifications. Additionally, we believed the connection of Dr. Jrbashyan and her daughter, Arpy Jrbashyan- a developer at Vectual- will increase clarity and effectiveness in communication between the AECP and development team.

Vectual had asked for one representative who they will be in regular contact with, and a representative who will give final approval on design and game features. The AECP has agreed with us that Dr. Nune Yeghiazaryan, will be the main source for final approval on all decisions, and Tamar Minasyan will be the day to day contact with Vectual.

Our runner up choice of developer was Alex. His design and business strategies were impressive, however his lack of experience developing games made us unsure of his ability to implement this app.

The chosen developer should be given our design document and further meetings arranged to iron out specifics.

2. Costs

Aside from developer expenses, a $99 annual cost for deploying the app onto the Apple iOS store may be charged from the developer, or may be included in their fees.

Developing for the Google Play store for Android devices is free.

If internet for the app is chosen to allow for videos to be downloaded, or future content to be released, space on a server will have to be purchased. Prices can range widely for hosting servers. For a small private server that only a few people are accessing, the cost can be as low as $50 a year.

For servers that need to handle thousands of requests concurrently and download GB of data, costs can jump to $10,000 monthly.
3. **Timeline**

While Vectual boasted an approximate timeline of the app to be developed in 2 months, we believe it should take no fewer than 4. Everything should be carefully examined and planned, especially during the initial design phase. It is much better to take the time to alter plans and design of the app before any coding begins, then to go back and change things after the fact.