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**Page URL:** <http://www.columbia.edu/~mic2130/final/index.html>

**GitHub Repository URL:** <https://github.com/aas2306/Final-Project>

### **Problem / Strategy**

1. One thing that people need to know is that developing a “growth mindset”, in which we engage with challenges and push out of our comfort zones, makes new and stronger neural connections in our brains, which makes us smarter. On the other hand, having a “fixed mindset”, in which we reject challenges due to fear of failure, impedes neural development.
2. The (actual) problem is that kids from the ages 7-10 currently do not have a “growth mindset” **attitude** towards difficult challenges.
3. The implication of this is that kids then develop a “fixed mindset” and thus shy away from challenges, which impedes the development of new neural connection and this is why it's important for learners to be able to / to do so.
4. In order to solve the larger problem, we can break it down. The main learning goal of developing a “growth mindset” **attitude** towards challenges is composed of the following sub-targets: (1) knowing basic **facts** about the brain, neurons, and neural connections in response to challenges; and (2) using personal experiences to **contextualize** this information and why it is meaningful for them to develop a “growth mindset” attitude.
5. That is, in order to achieve the the “growth mindset” attitude, each sub-target is a requisite piece of the larger objective. The learning target has been achieved if, when faced with a new difficult task, learners are willing to work through it.

### **Scope: Content — No more than three maximum (can be done in less)**

In order to successfully teach this topic, the following three major content pieces must be included:

1. A video that teaches the basic neuroscience facts of a growth and a fixed mindset. It will use age-appropriate language to explain how our brains are capable of growing in capacity when we put in effort to work through difficult tasks, and that the way that they grow “stronger” is by creating new connections between neurons. Throughout the video, the narrative will also ask open-ended questions to help the user contextualize and remember personal experiences in which they struggled through something that was originally difficult for them, but that they then became better at doing (e.g., doing gymnastics, reading chapter books).
  - a. The video will address the two sub-targets: It will give the users the **facts** they need to know about how the brain makes more connections when we are engaged with a challenge. By giving prompts that are related to their prior experiences, the video will also

- contextualize** the information for them, so that they can make more meaningful associations between their experiences and the neuroscience facts.
- b. The cognitive state of the learner will change by contextualizing prior experiences within a new subject area (the neuroscience behind growth/fixed mindsets).
2. The second piece of content will be a game. The user starts with an image of a brain that has various unconnected neurons, and in order to make connections (i.e., to progress in the game), the user has to answer math-related logic questions and puzzles and answer in the form of a number input. The user can make either regular connections when choosing a question of the same level on which they are on, or super connections when they choose to go to harder level question. A neuron connection is blocked when the user decides to skip a question, or when they skip after getting it incorrect instead of trying to correct it. The end goal is to have the most connected brain, with as many super connections as possible, and the least blocked connections.
- a. The learning target addressed through the game is that of developing a growth mindset **attitude**, since it is set up to reward *effort* (for choosing TRY AGAIN instead of SKIP when they get the answer incorrect) and the taking of *challenges* (for choosing HARDER LEVEL questions instead of SAME LEVEL questions), while also punishing the user for shying away from a challenge (by blocking a connection if they SKIP).
  - b. Unlike traditional quiz-like games, where users are rewarded for getting the correct answer, and punished when they get the incorrect answer, this game is set up to reward effort and taking on challenges, which will set users on a completely new and unfamiliar cognitive state. This change in thinking is essential for developing a growth mindset attitude.
3. The last piece of content (when the game ends) will be a prompt that will ask the user to apply their newly-developed growth mindset attitude in the next difficult challenge that they encounter (either in or outside of school) with the aim to assess whether they are more willing to work through a challenge as an indicator of a growth mindset.

The sequence of the content is set up so that the learners will first become familiar with what happens in our brains when we work through difficult tasks, as well as relate to experiences that can help them understand how they become smarter when they work hard. At this point, they will be in a cognitive state appropriate for the game. Since it rewards effort and taking of challenges, the users are more likely to take steps towards subsequently harder math logic questions, instead of taking the easy questions or skipping questions. At the end of the lesson and game, the user will be more likely to have a growth

mindset attitude, which will be assessed in whether they are more willing to work through a new difficult task (the final assessment is external to the website).

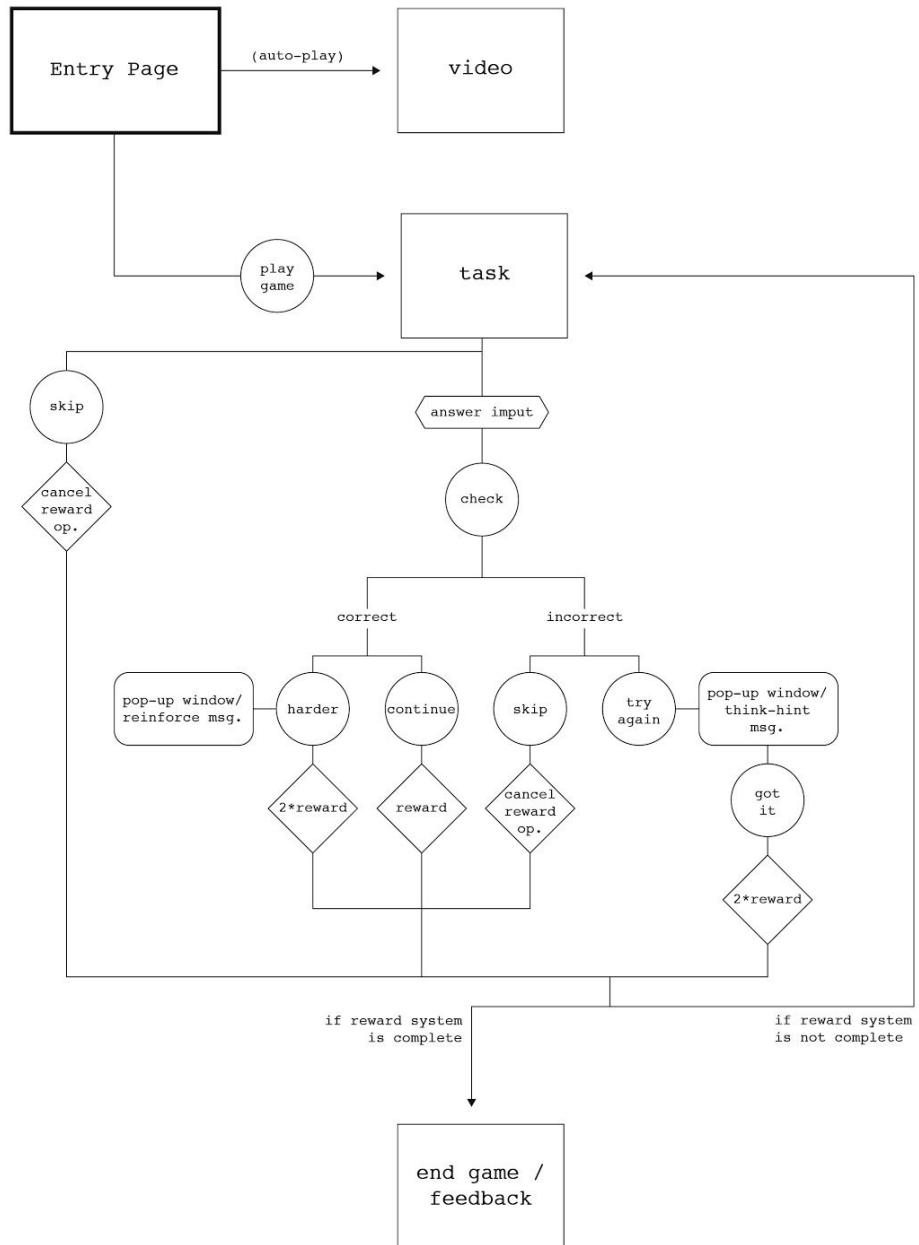
**Scope: Functionality — No more than three maximum (even this can be too much)**

The game will have interactive functionality, outlined below:

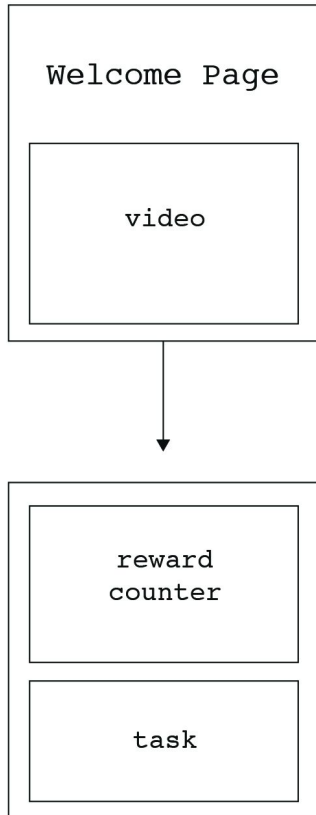
1. For each quiz game question, the user will have two options:
  - a. SKIP the question → the system responds by eliminating the potential of two neurons in the Brain from connecting (blocking a connection). The purpose is to punish the skipping of questions by taking away the opportunity of a connection in the Brain. If the user skips a question, the next question will be of the same level of difficulty as the one they skipped.
  - b. ANSWER the question → They get the answer either correct or incorrect:
    - i. Correct answer → The system gives feedback that the answer is correct, and then presents two choices for the next question:
      1. SAME LEVEL question → If the user chooses this, the system makes 1 regular connection in the Brain, and they get 1 Brain Point.
      2. HARDER LEVEL question → If the user chooses this, 1 super connection is made in the Brain, and they get 2 Brain Points.
    - ii. Incorrect answer → The system gives feedback that the answer is incorrect, and then presents two choices:
      1. SKIP the question → If the user chooses this, the Brain gets a blocked connection, and the user gets 0 Brain Points.
      2. TRY AGAIN → If the user chooses this, the system gives a hint/encouragement to help them answer the question, and they have an unlimited number of possible attempts to answer it. Each time they TRY AGAIN, they get 1 Brain Point. Once they get the correct answer, 1 super connection is made in the Brain.

**Structure:**

1. Interaction Design



## 2. Information Architecture

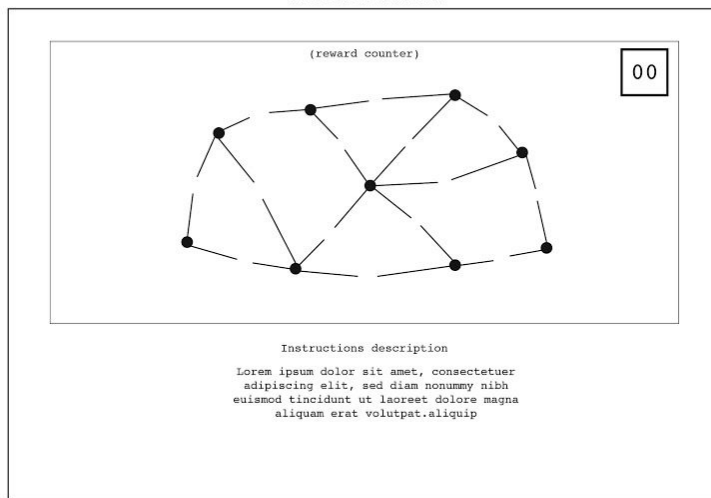


**Skeleton:**

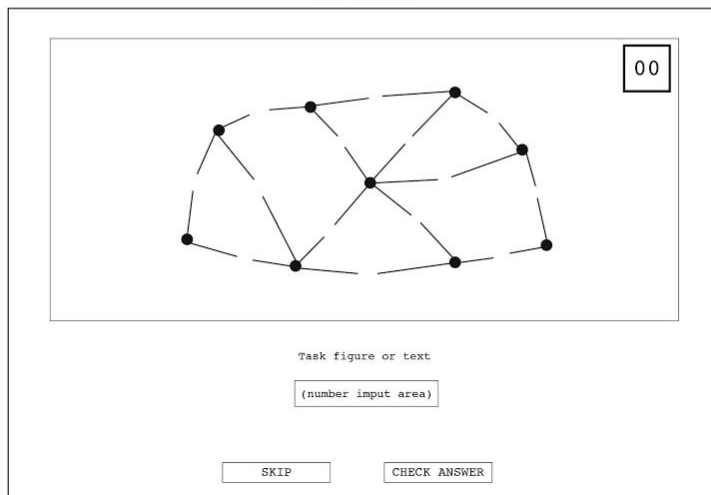
1. Produce a very basic wireframe of your single page before you produce the code.



INSTRUCTIONS WIREFRAME

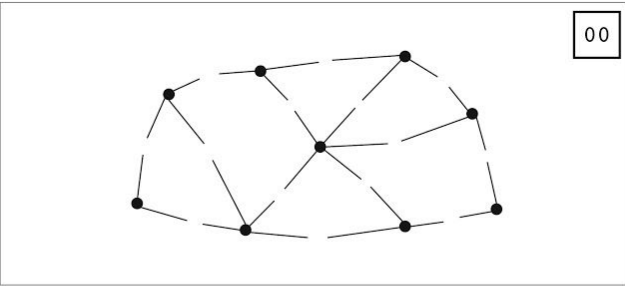


TASK WIREFRAME



(if check and correct)

00



Task figure or text

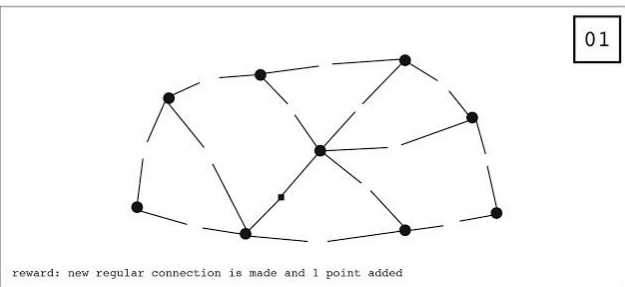
answer / input area  
blocked

feedback correct

CONTINUECONTINUE HARDER

(if continue)

01



reward: new regular connection is made and 1 point added

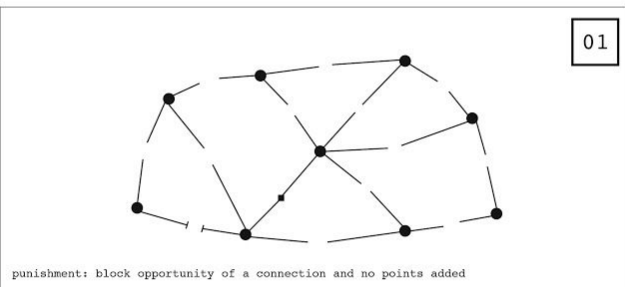
Task figure or text

(number input area)

SKIPCHECK ANSWER

(if skip)

01



punishment: block opportunity of a connection and no points added

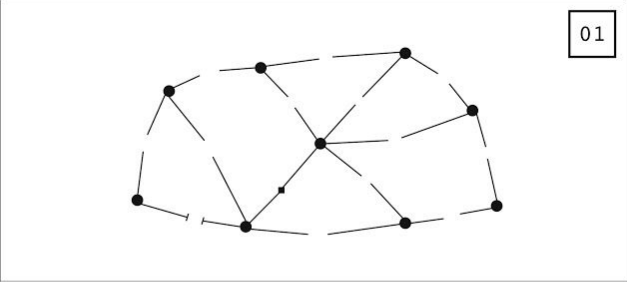
Task figure or text

(number input area)

SKIPCHECK ANSWER

(if check and incorrect)

01



Task figure or text

answer / input area  
blocked

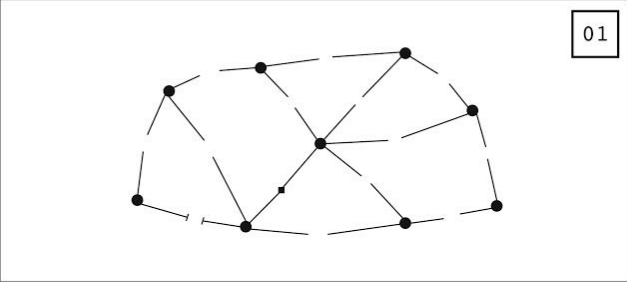
feedback incorrect

SKIP

TRY AGAIN

(if try again)

01



Task figure or text

Think-Hint and  
encourage message

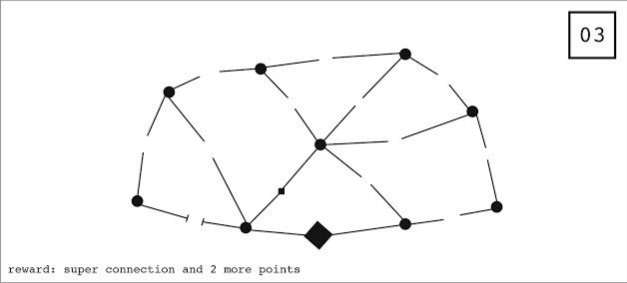
SKIP

got it

TRY AGAIN

(got it)

03



reward: super connection and 2 more points

Task figure or text

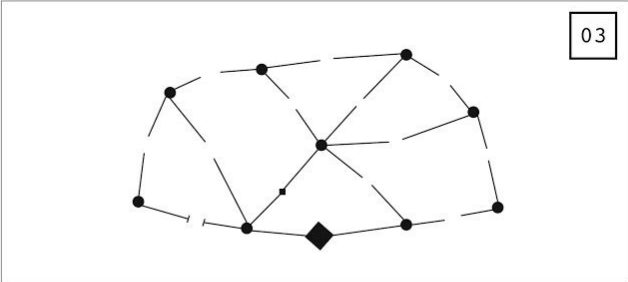
number input area

SKIP

TRY AGAIN



03



Task figure or text

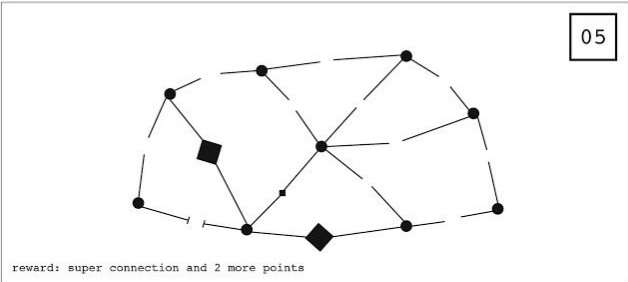
answer / input area  
blocked

feedback correct

CONTINUE CONTINUE HARDER

(if continue harder)

05



reward: super connection and 2 more points

Task figure or text

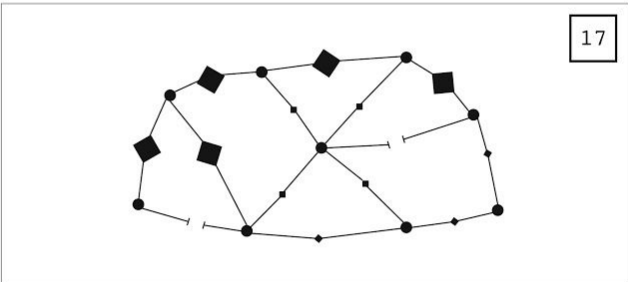
answer / input area  
blocked

feedback correct

CONTINUE CONTINUE HARDER

(if reward counter complete)

17



Game complete  
feedback message

17/28

exit

## Reflection

Our design thinking during the creation of this final project was heavily influenced by Schwartz's wheel. At the beginning of the process, we sat down and discussed our topic of interest -- growth mindset -- and brainstormed on what type of lesson we could create, and what outcomes we would like to see in the user. Although we changed the desired outcomes a few times, finally settling on the development of a growth mindset attitude, the constant discussion clarified many issues along the way that we believe would have persisted had we been working independently, such as confusions between interest and contextualizing, or between familiarity and discernment. We also challenged each other's ideas while coding, and helped each other learn previously unknown ways of doing things.

We both felt that we tend to get caught up in details because we strive for near-perfection, Adriana especially with the interactive experience, and Maria with the visual experience. However, we managed to keep each other in check, while still being in agreement that while we wanted a well-functioning, good-looking website, the important thing in the end was that the user actually learned something. Overall, it was great to work in a team, and we both believe that we probably would not have created such a well-developed project and game had we been working on our own.