Designing for Learning Differences

Previous classes

Understanding the Problems

- Poverty and bias negatively affects educational opportunities
- Female representation in media
- Designs fail for women and minorities
- Cultural representation in games

Exploring some Solutions

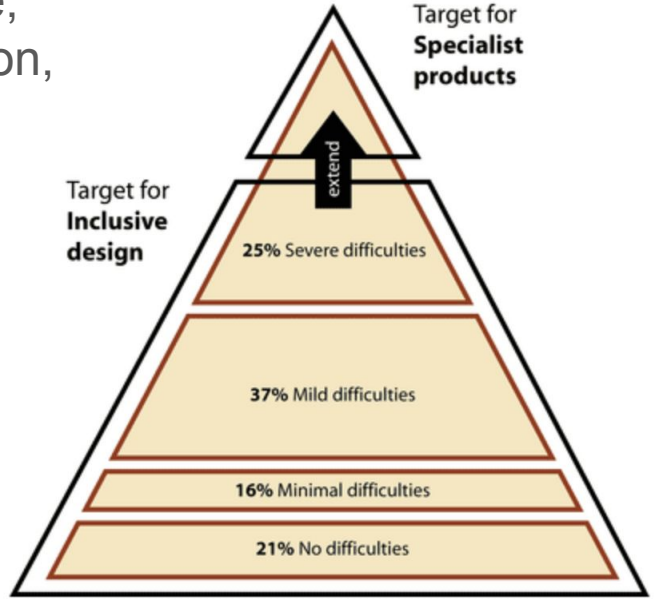
- Culturally Relevant Design in Education
- Culturally Relevant Design in Game

Today's Class

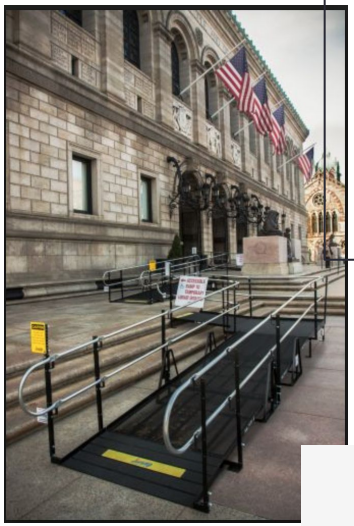
- Accessibility / usability barriers (physical or cognitive)
- Inclusive Design
- Universal Design for Learning

Inclusive Design

Inclusive design centers the needs of the *widest possible* group of users, regardless of ability, age, economic situation, education, geographic location, or language



What happens when you design for equity?



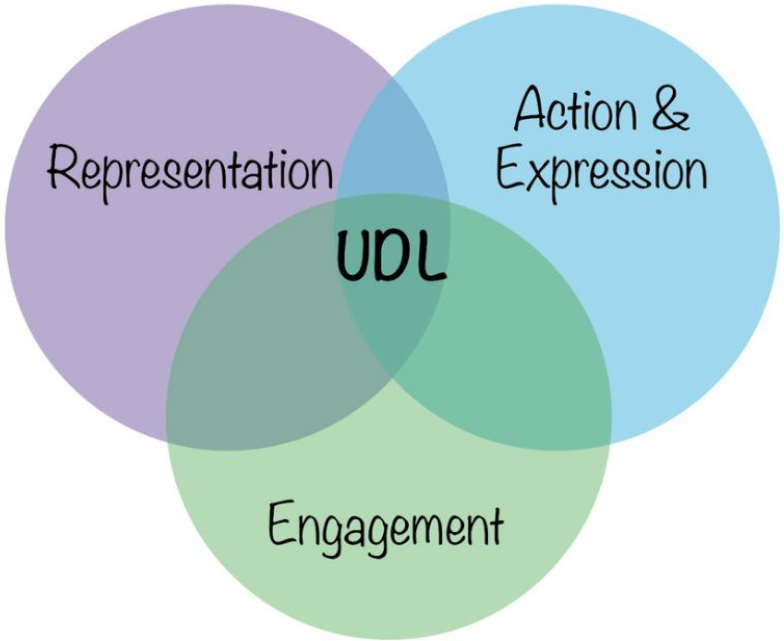
icons8.com

icons8.com

Highlights the need to design aspects that are:
-**Necessary** for SOME,
-**Beneficial** for ALL, and
-**Not detrimental** to ANY.

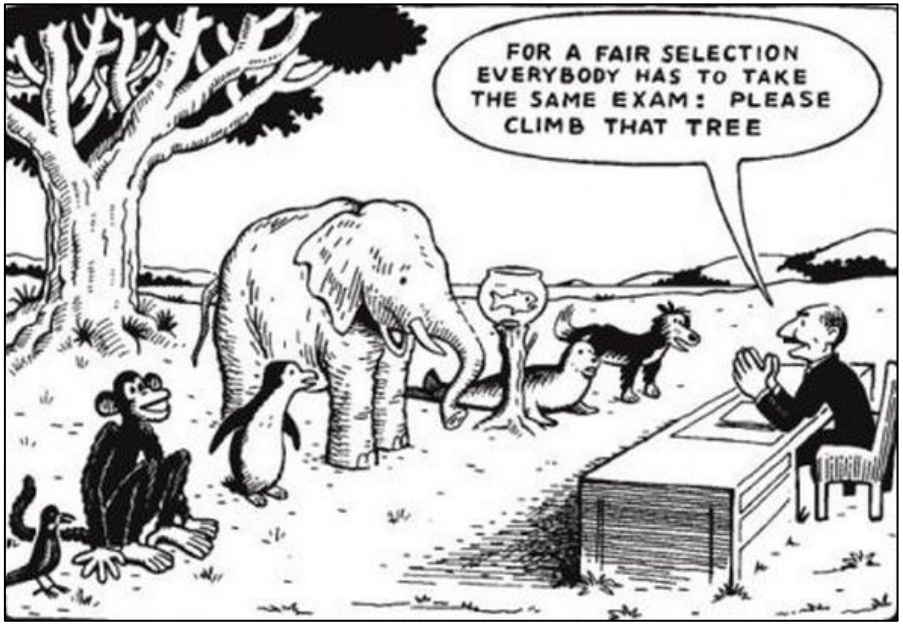
Universal Design for Learning (UDL)

Universal does not mean **one** solution, it means a solution for **everyone**



Differentiation

"A **flexible approach** to teaching in which the teacher plans and carries out **varied approaches** to **content**, **process**, and **product** in anticipation of and **in response to student differences** in readiness, interests, and learning needs" (Tomlinson 2001)



Not like this!

DIFFERENTIATING FOR DIVERSITY:

USING UNIVERSAL DESIGN FOR LEARNING IN COMPUTER SCIENCE EDUCATION

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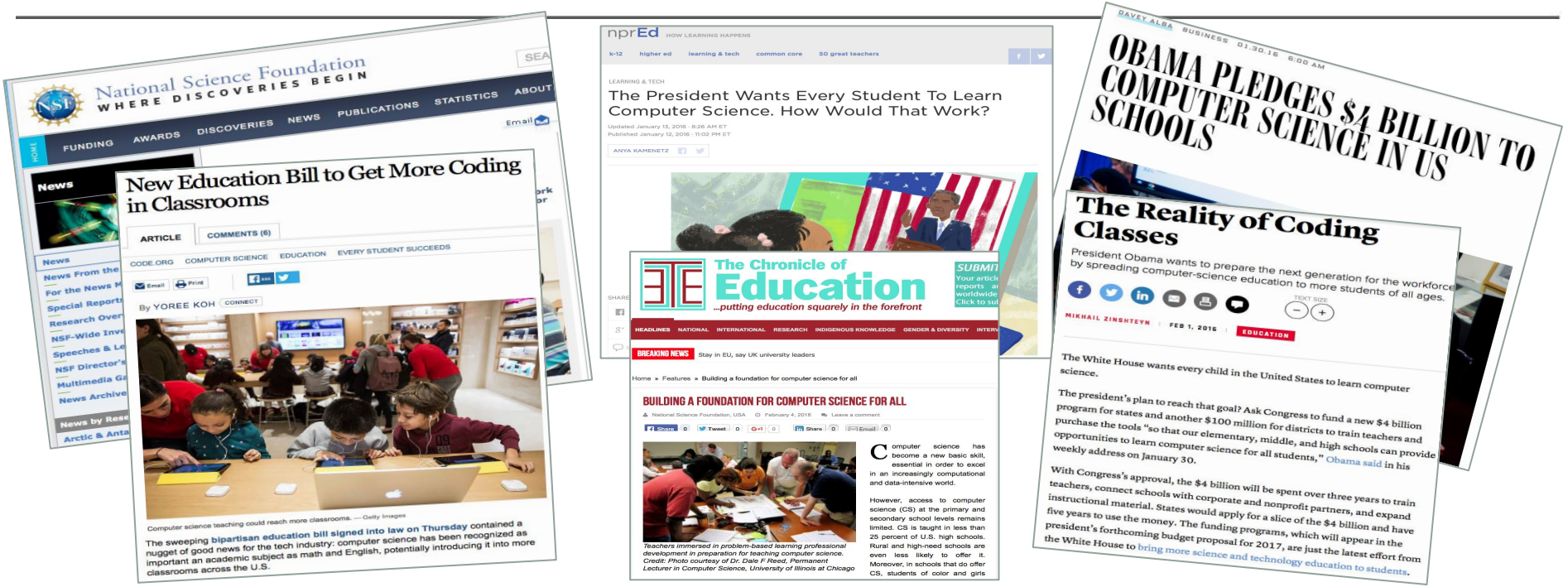
Eric R. Hansen, SPED Educator
Hilary A. Dwyer, University of Colorado Boulder
Danielle B. Harlow, UC Santa Barbara
Diana Franklin, University of Chicago

Computer Science for ALL

In the coming years, we should build on that progress, by ... offering every student the hands-on computer science and math classes that make them job-ready on day one.

- President Obama in his 2016 State of the Union Address

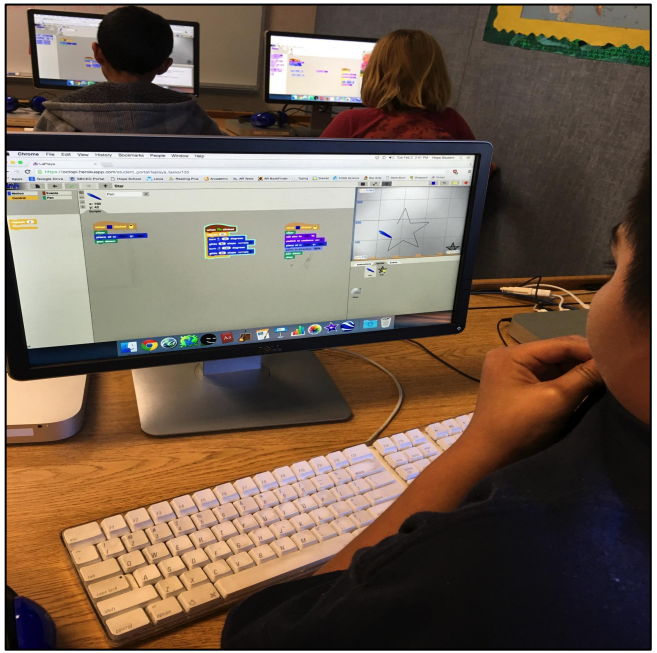


What does FOR ALL really mean?

How do we actively support students who do not *already* have opportunities to learn computer science?

This includes, but is not limited to:

- Students learning English
- Students from historically marginalized groups
- Students with learning differences
  (and/or diagnosed learning disabilities)
- Students below grade level
- Students raised in low-income families
- Without regular access to technology
- With low motivation or perseverance



Ways to Differentiate for ALL Students

1. Universal Design for Learning (UDL)

Highlights the need to design aspects of instruction that are:
-**Necessary** for SOME,
-**Beneficial** for ALL, and
-**Not detrimental** to ANY.

TIPP&SEE Worksheet

Start by Playing (mindfully)

Play: Run the project and see what it does! Look at which sprites are doing the actions.

What happened when you played the project? Circle the action(s) that happened for each event.

1. When I clicked the green flag:		
Monkey talked waved flag	Snake talked hissed wiggled moved down moved right	Bee talked buzzed wiggled moved down moved right

4. Which block detects that the snake cheated by going through the middle?

5. Which code makes the program **constantly** check for the sprite winning or cheating?

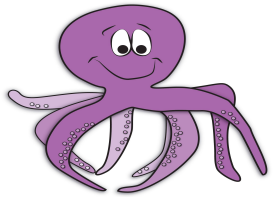
Designing for English Proficiency

-Simplified & clarified instructions.

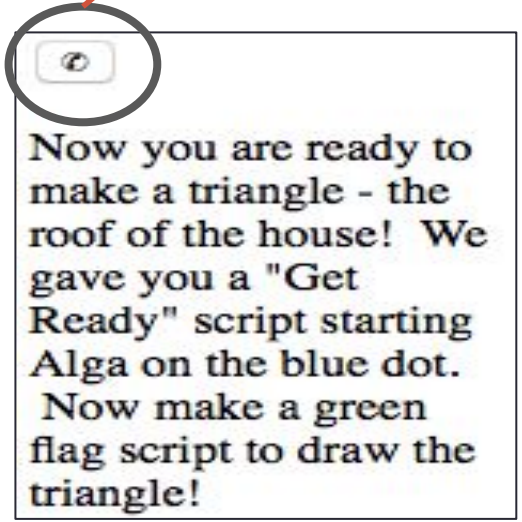
-Reduced required reading/writing on student worksheets.

-Embedded more text within the interface.

-Added audio read-aloud function



Audio Read Aloud Function

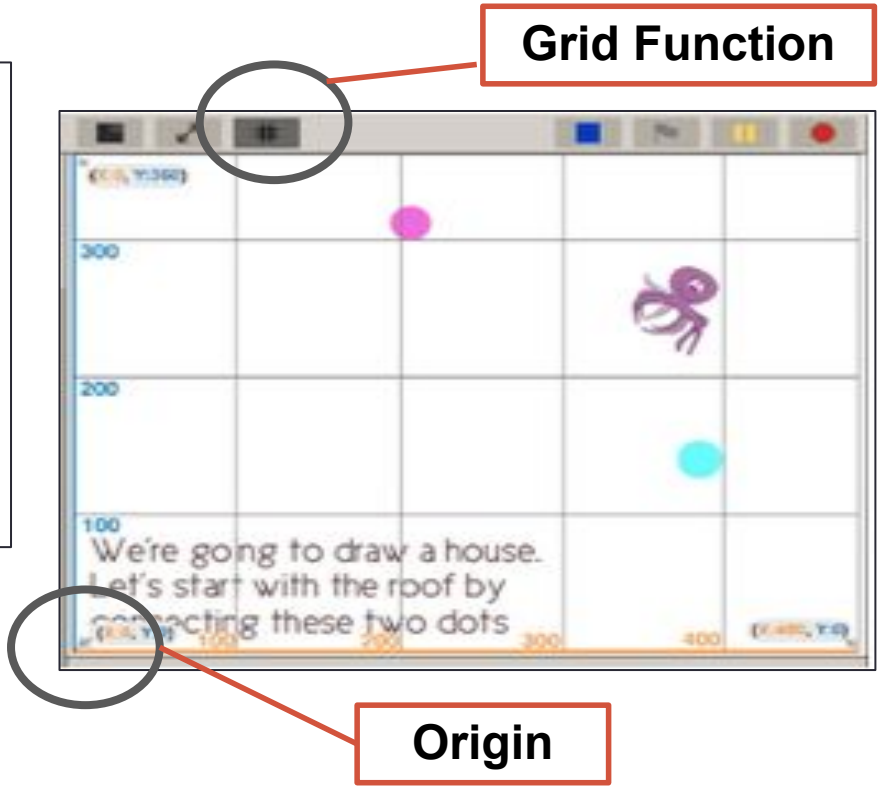


For more information, see:
Dwyer, H., et al. (2015). Programming languages and discourse: Investigating the linguistic context of learning computer science during elementary school. Presented at the AERA Annual Meeting.

Designing for Math Proficiency

-Removed negative numbers, decimals and percentages.

-Changed location of origin within coordinate plane system and added a grid function.



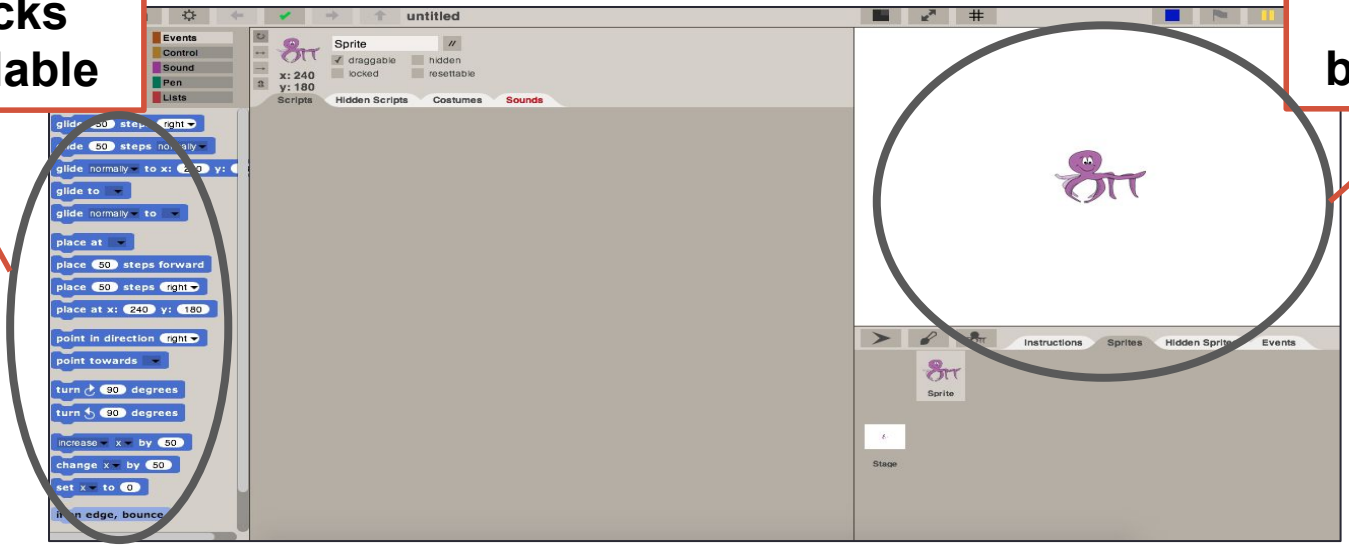
<u>For more information, see:</u>

Hill, C., et al. (2015). Floors and flexibility: Designing a programming environment for 4th-6th grade classrooms. Presented at SIGCSE.

Designing for Varied Student Pace

Created the **Sandbox** – a designated, open-ended play area to experiment and practice for students who finished assigned tasks early.

All blocks are available



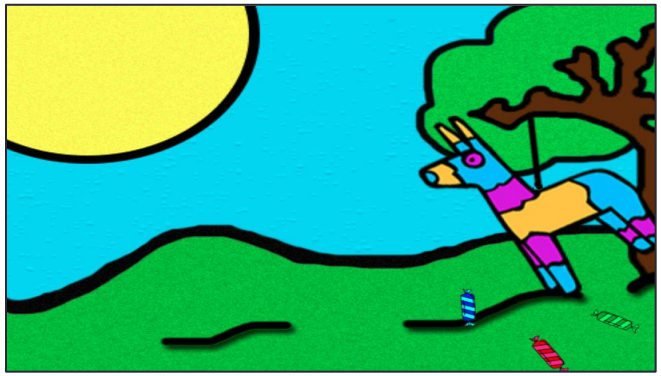
Opens a blank project

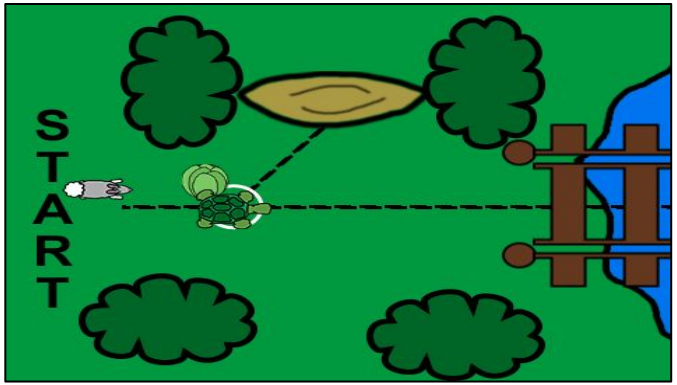
Designing for Culture

-Conducted interviews with students to ensure examples were culturally-relevant (e.g., piñatas, quesadillas).

-Ensured programmable characters of every ethnicity were available.

-Changed language of the “tortoise and hare” project, and included the story.





Breakout — Reflection

Think about one of your favorite video games.

Does this game present any usability **barriers** for users with different cognitive or physical abilities?

Does this game have any features that **support** a wide range of users' abilities?

Discuss with a partner and record on Gradescope!

Breakout — Inclusive Design Process

As designers, what are some of the **challenges** of following inclusive design practices?

What are some potential **solutions** and/or **approaches** to these challenges?

Discuss with a partner and record on Gradescope!

Universal Design Challenges and Approaches

Challenges:

- some games depend on a certain pre-existing knowledge
- some games (later levels) are supposed to be harder/quicker
- can be challenging to adjust existing game after it's already developed
- budget constraints
  - voice overs cost money
- some features could be good for some users but bad for other users
- sometimes there are pre-existing platform constraints

Approaches:

- focus group to design game features with
- don't require to complete all levels to win
- practice environments, interactive tutorials
- consulting with an expert about what impairments to design for, and how
- incorporate/center usability from the start
- different game modes

Breakout — Disability Simulators

Try out one or both of the vision simulators listed in Gradescope.

What are the pros and cons of using a tool like this as a designer?

Discuss with a partner and record on Gradescope!

Disability Simulators

Pros:

- tool can be used to check assumptions about design decisions
- easy way to try and make your game more usable or accessible
- cheap!

Cons:

- missing the nuance that a person might be able to provide
- manual upload misses the full scope of the project
  - screenshotting is time intensive!
- might imply that there's one solution, instead of a multitude of solutions/options

Disability Simulators

Pros:

- Build empathy

Cons:

- Can center the initial trauma of losing an ability over the learned skills of people with disabilities
- Can reinforce stereotypes about difficulties, rather than share stories of resilience

Breakout — UDL Solutions

In small groups, brainstorm and/or research UDL solutions for users with:

- Vision impairment
- Hearing impairment

Vision impairment – Inclusive Design Suggestions

- Use patterns instead of colors when color is meaningful
  - Or use high contrast colors
  - Shapes or icons work too
- Give non-visual feedback (tactile, auditory)
- If you’re using patterns, be consistent throughout the game

Hearing impairment – UDL Suggestions

- Use visual cues along with auditory cues
  - see video game accessibility toolkit paper!
- Visually indicate where events are happening (not just using sound)
- haptic feedback
- customize background/foreground audio – different users want/need different levels!

Breakout — UDL Solutions

In small groups, brainstorm and/or research UDL solutions for users with:

- English language learners
- Low attention span
- Cognitive impairment (such as poor memory or slow processing)

English Language Learners:

- use images when possible instead of long blocks of text
    - especially in instructions!
- prioritize music and numbers to convey a theme/vibe
- utilize community for translation checking

English Language Learners:

- Check the reading level of your text and make sure it is below grade level
- Include images with text to give extra cues to meaning
- Make sure spoken text is spoken very clearly
- Allow option to read out text
- Structure page in a traditional format so that people can figure out where to put their eyes

Low Attention Span:

- break overall game into smaller goals
- keep narrative scenes short
- allow for pausing without losing progress
- use vibrant colors, visual intrigue to keep attention
- research how and when users lose focus to know what to address
- avoid long blocks of text
- provide immediate feedback

Low Attention Span:

- Don’t have long blocks of text without images
- Have the option to replay things in case they miss them
- Forms / submitting text – say how long they will take and have option to save progress
- Require user input to advance so user is ready
- Break up game into small chunks / levels
- Simplify user interface
- Don’t make time limits too important

Cognitive Impairment:

- take time to learn what kinds of impairments users might have
- use a setting to adjust quick thinking/reflexive thinking
    - allow for customization!
- allow for customization of features (difficulty, speed, etc)
- allow players to revisit what's already happened

Cognitive Impairment:

- Split into steps and provide instructions for different steps
- Include interactive tutorials when possible
- Allow access to previous levels (with instruction)
- Checklists
- Hint button
- Organize it well so they aren’t overwhelmed by information

Project Group Discussion

In project groups, brainstorm specific design additions to **your game** for users with learning differences including (but not limited to): [10 mins]

- English language learners
- Students below grade level
- Students with low attention span
- Students with low executive functioning
- Students with visual impairments
- Students with auditory impairments

For Wednesday

Complete Design Review feedback on Gradescope!