Friends with Different Abilities:
An Educational Computer Game

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2016-17 **Science Fair** (who did or judged??)

All pictures, images, figures, charts, tables, were taken or made by the researcher or mentor.

Purposes/Hypotheses

- **Two tested purposes**
  - To see if an educational computer game can be made to present concepts about disabilities and
    - **Hypothesis #1** (H1):
      A computer game can be made
      to present information about disabilities.
  - To see if people can learn about disabilities from playing the game
    - **Hypothesis #2** (H2):
      A person can learn from an educational
      computer game about people with disabilities.

So that people might have a better **understanding and acceptance** of people with different disabilities
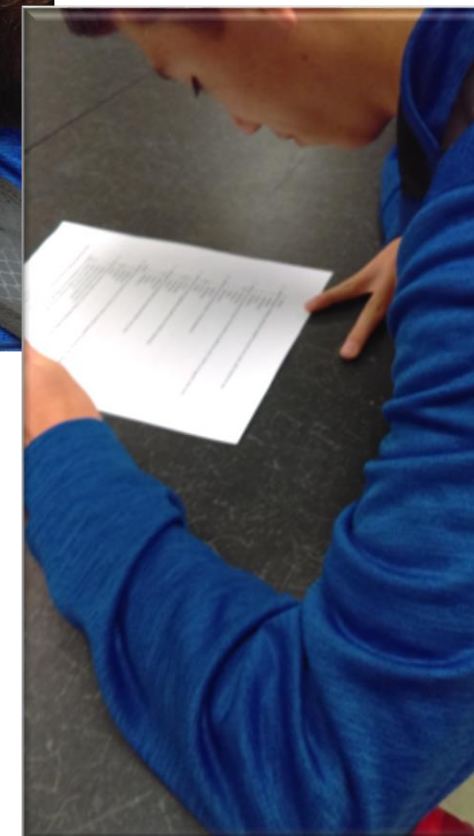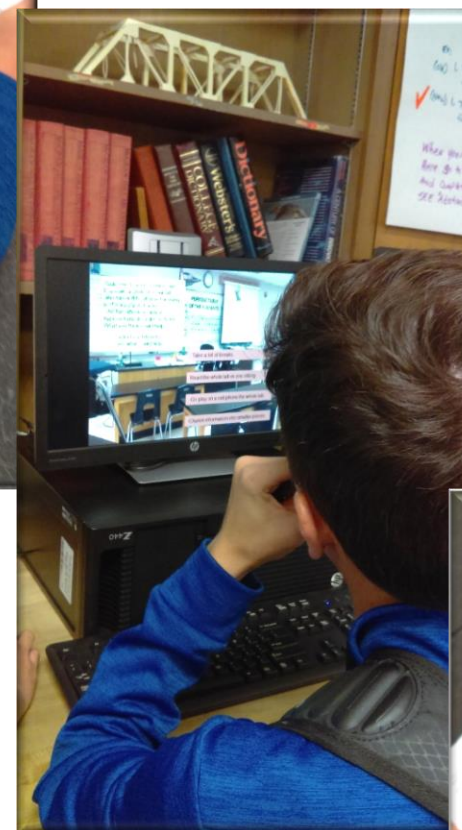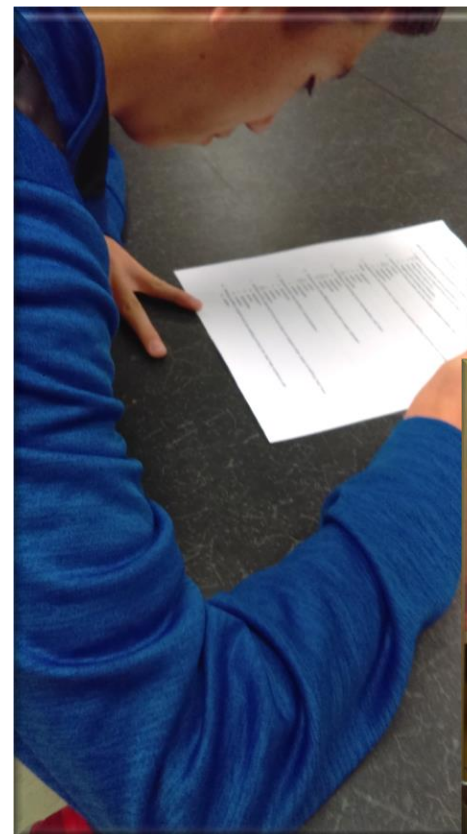
Background Information

- About 13% of public school students in the United States have some sort of **disability**.
- Most of the disabilities in schools are about **learning**.

- A game/computer game has
    - environment, players, rules, feedback, and goals
- People bringing what works about gaming into learning situations is called **gamification**.
- Many benefits of computer games have been shown.
- No computer games about disabilities were found.

    www.EducationalComputerGaming.com – search

- The researchers have friends with disabilities and friends with family members who have disabilities
- The game may help people learn about disabilities so that there could be more understanding and less bullying.

Materials *– Science fair requirement*

- **<u>Laptop computer</u>** with Microsoft (MS) Windows
  - MS Word
    made **<u>pre-test</u>**
    made **<u>post-test</u>**
    made design
    wrote report
  - MS Excel
  - MS Paint
  - **<u>GameMaker</u>**
    made **<u>FwDA game</u>**
- Camera/phone
- USB flash drive

  and various computers
  to run the game

Procedure *– Science fair requirement*

1. The Special Education Coordinator at John Jay High School (in San Antonio) was interviewed about disabilities.
2. Background information was gathered about disabilities and educational games.
3. **Pre-test and post-test** were developed.
4. Pictures were taken of classrooms, halls, and objects.
5. The storyboard **design of the game** was made to present information about people with disabilities (*Sep*. 2016).
6. The **game was developed** in GameMaker (*Oct*. 2016).
7. 100+ people were invited to participate.
8. Students were given informed consent forms to sign.
9. 69 participants (*12-63 years old*) took a pre-test, **played the game**, and then took the post-test (*Nov. 6 - Nov. 22*, 2016).
10. Pre- and post-test results were graded and analyzed.
11. A report was written and presentation created.

Sample Test Questions

- 14 multiple choice questions on the tests
- Different wording for some questions
  - A person with dyslexia…
    - a. mixes up letters and has trouble reading.
    - b. has trouble writing including grammar, spelling and usage issues.
    - c. has difficulty memorizing and understanding math facts.
    - d. is moving around a lot and not focusing.
  - Someone who mixes up letters and has trouble reading probably has…
    - a. ADHD.
    - b. dyslexia.
    - c. Asperger's.
    - d. dysgraphia.
- On both pre- and post-tests
  - About what percent of public school students in the U.S. have a disability?
    - a. 8%   b. **13%**   c. 18%   d 25%

Game Design

- Storyboard pages
  - Dialogue, images, activities
- Rooms:
  - Social Studies- **Dysgraphia**
  - Computer- **Asperger's**
  - P.E./Gym- **Physical**
  - Math- **Dyscalculia**
  - English- **Dyslexia**
  - Science- **ADHD**
  - Library- **Autism**
  - Language Lab
  - Bus
- Pictures and images:

Andy for gym.png | bus IMG_7113.JPG | Calculator for math.png | class - computer IMAG0197.jpg | class - English IMAG0182.jpg | class - gym IMAG0185.jpg

class - language lab IMAG0191.jpg | class - language lab IMAG0192.jpg | class - math IMAG0180.jpg | class - science IMAG0186.jpg | class - SEA IMAG0177.jpg | class - SEA IMAG0179.jpg

class - social studies IMAG0181.jpg | class -library IMAG0152.jpg | Computer for SS2.png | Dysgraphia writing.jpg | Glasses for gym small.png | graph paper for math.png
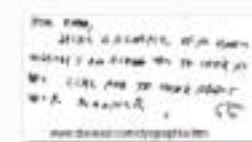
ipod for math.png | Jj door horz.jpg | Jj door vert.jpg | JJ front 9-17-16.jpg | JJ Hallways.jpg | JJ Wall.jpg

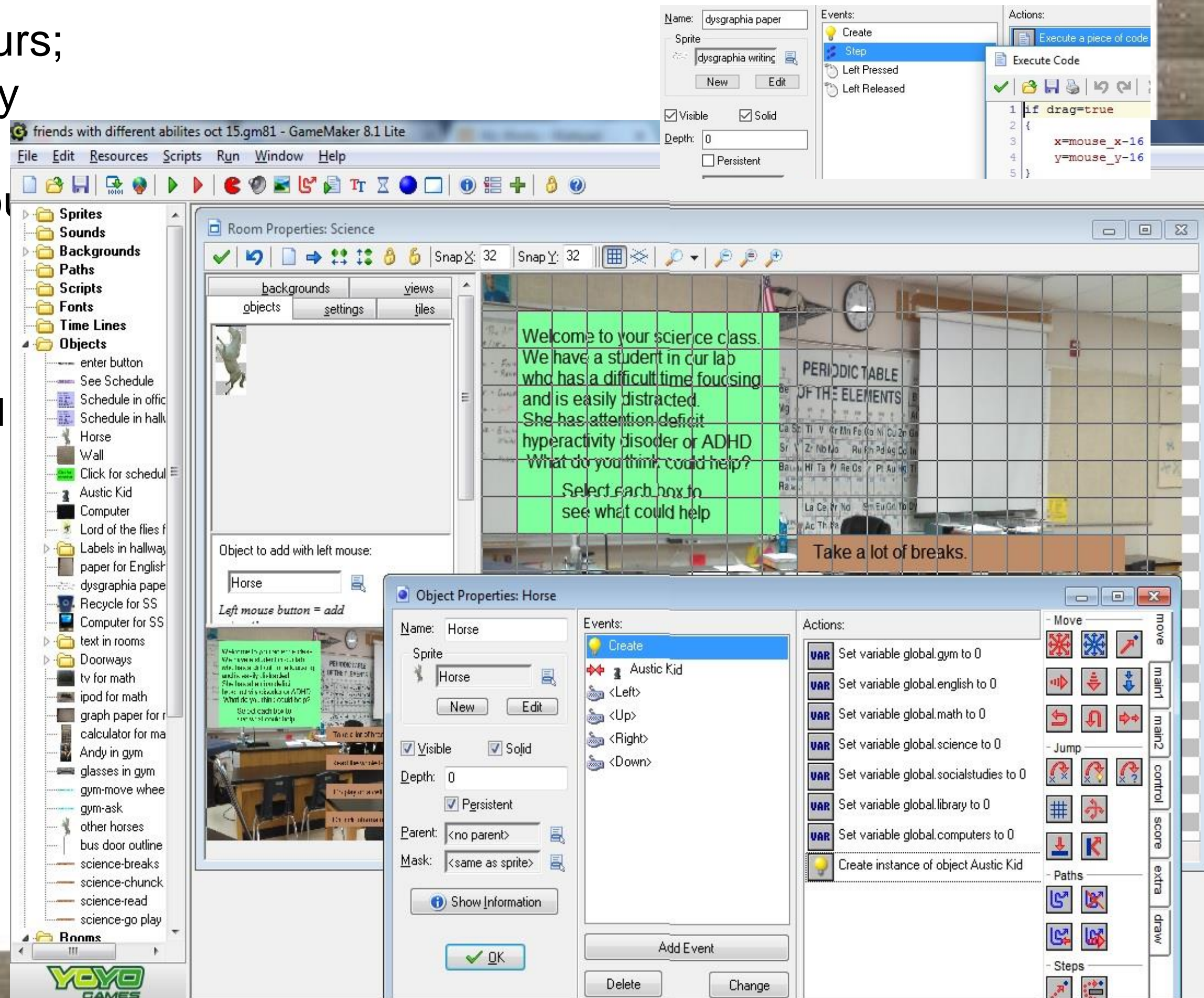lord of the flies.png | Mustang no background.png | Paper for English.png | Recycle bin small for SS.png | tv for math.png
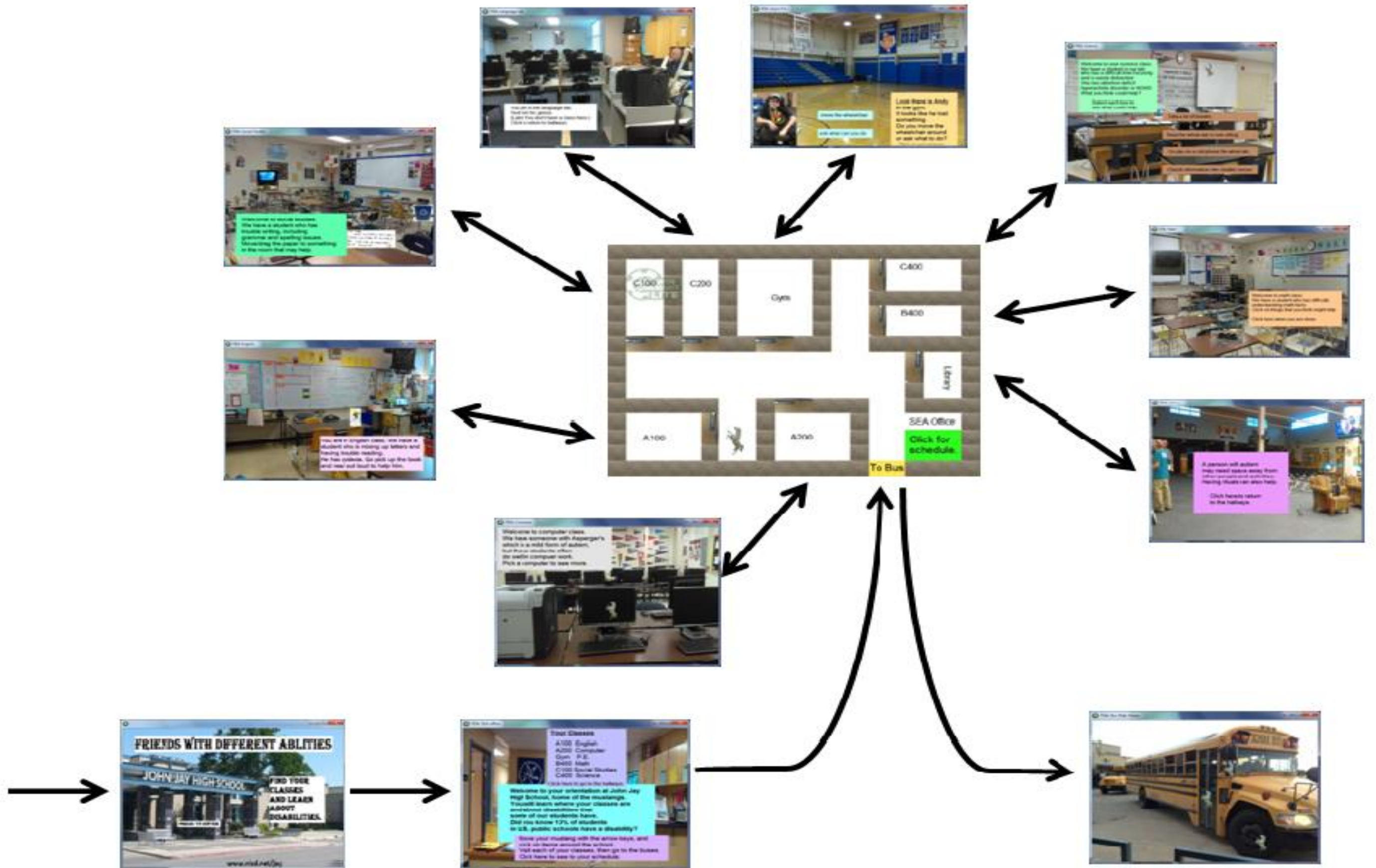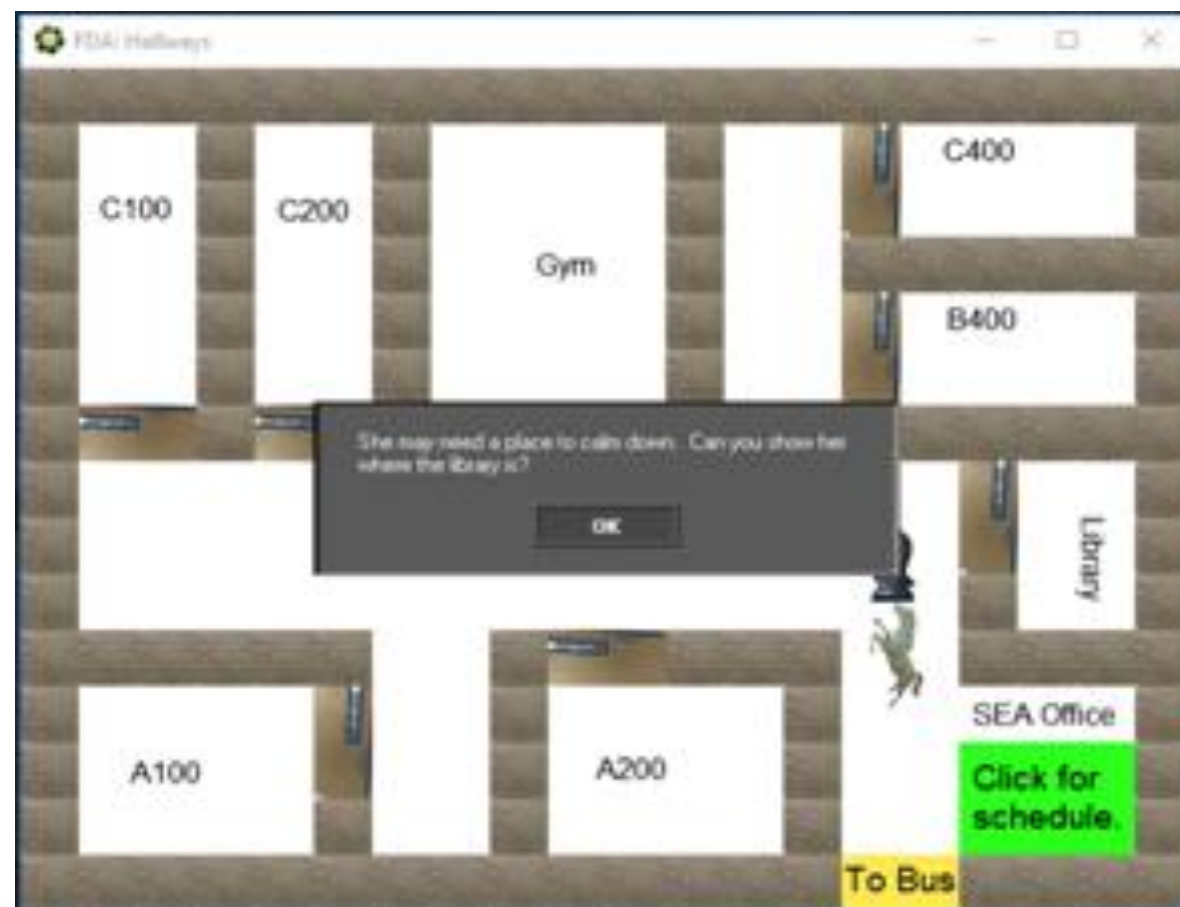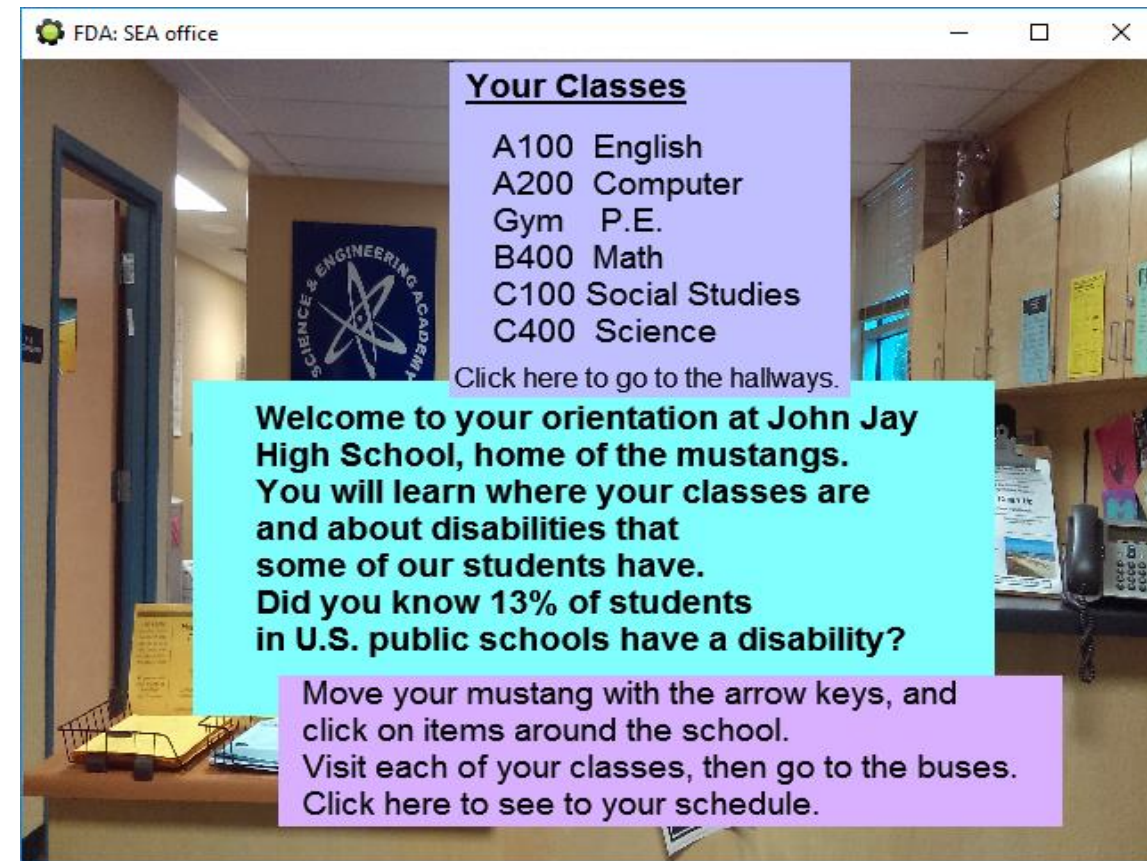
Game Development

80 person hours;
25 min. to play

- 11 Backgrou...
- 54 Sprites
- 57 Objects
  many with **events** and **actions** to give behaviors
- 12 Rooms

  7 of them have a disability presented
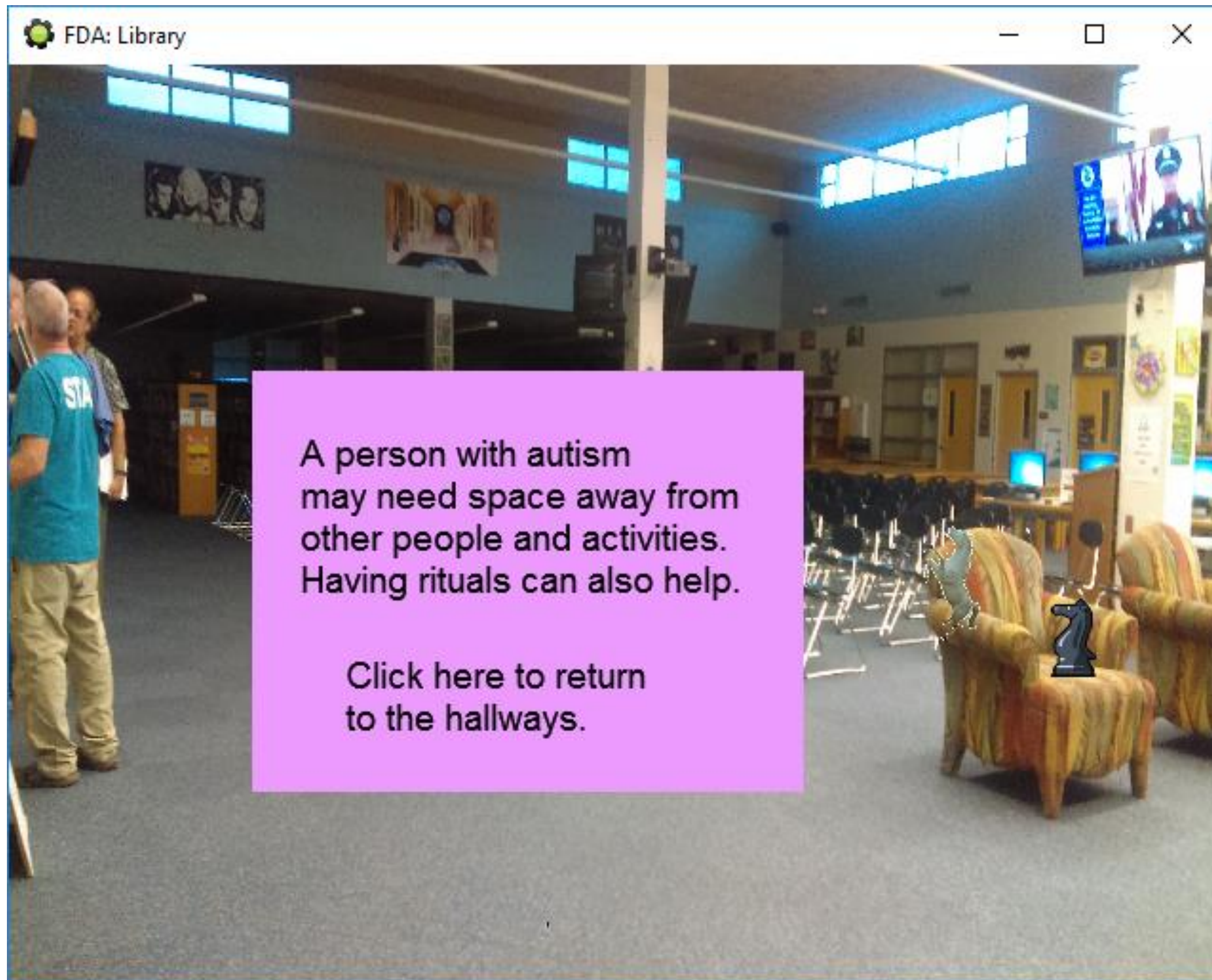
Game Flow *play game or show next slides*
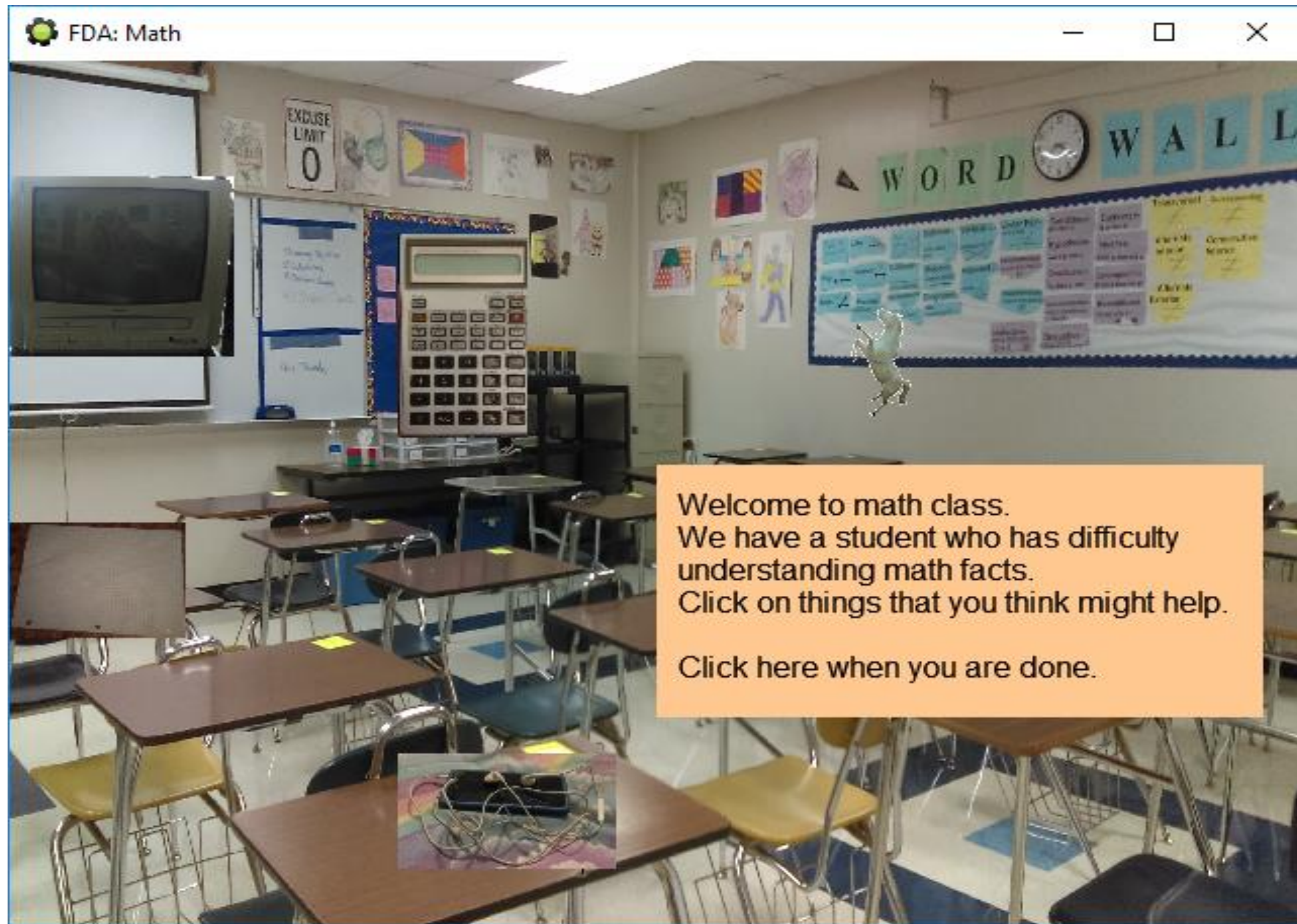
First Three Rooms

The player goes back to the hallway after completing an activity in each classroom.

Library- Autism

Math- Dyscalculia

Science- ADHD

Computer Lab- Asperger's

Gym- Physical
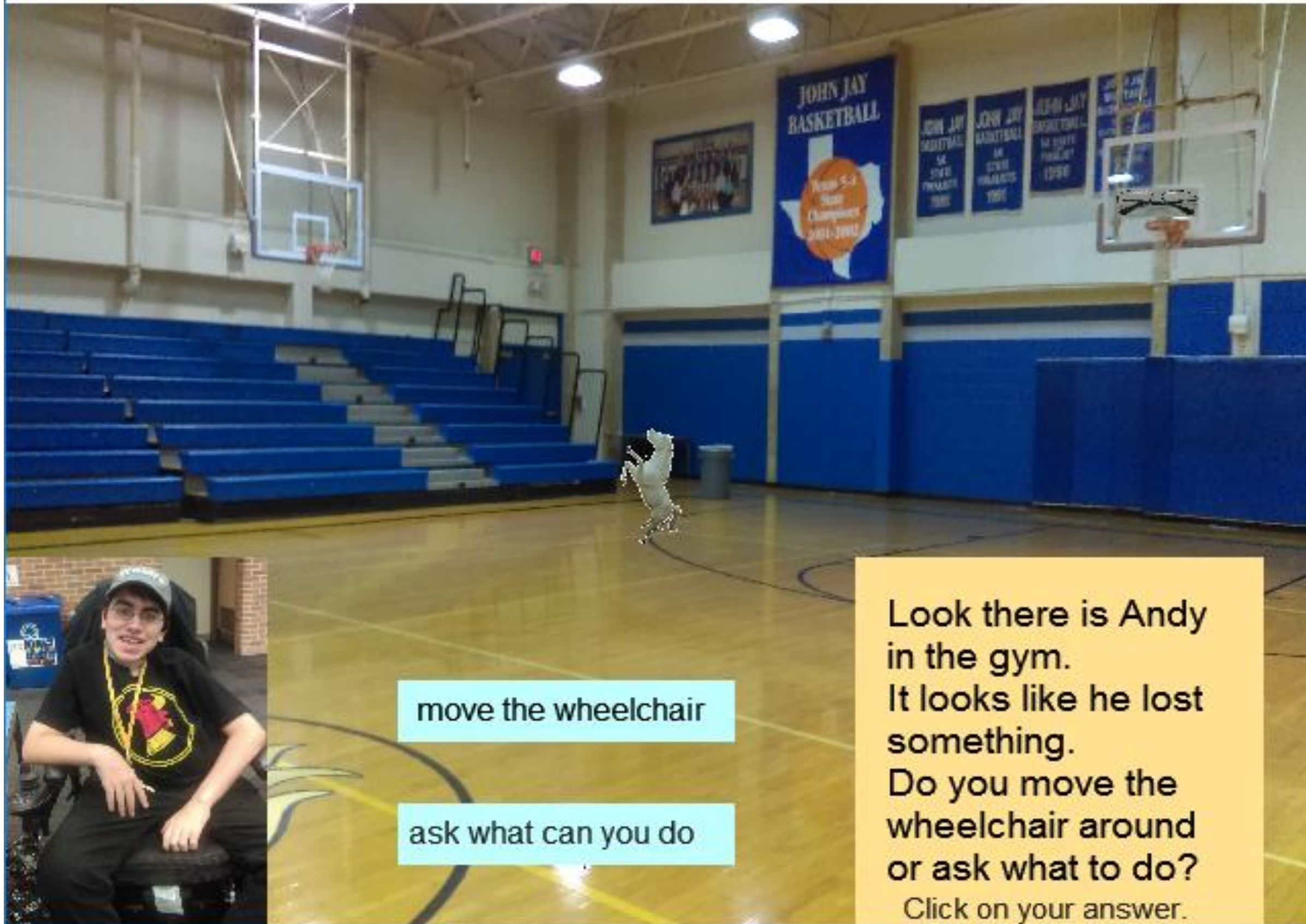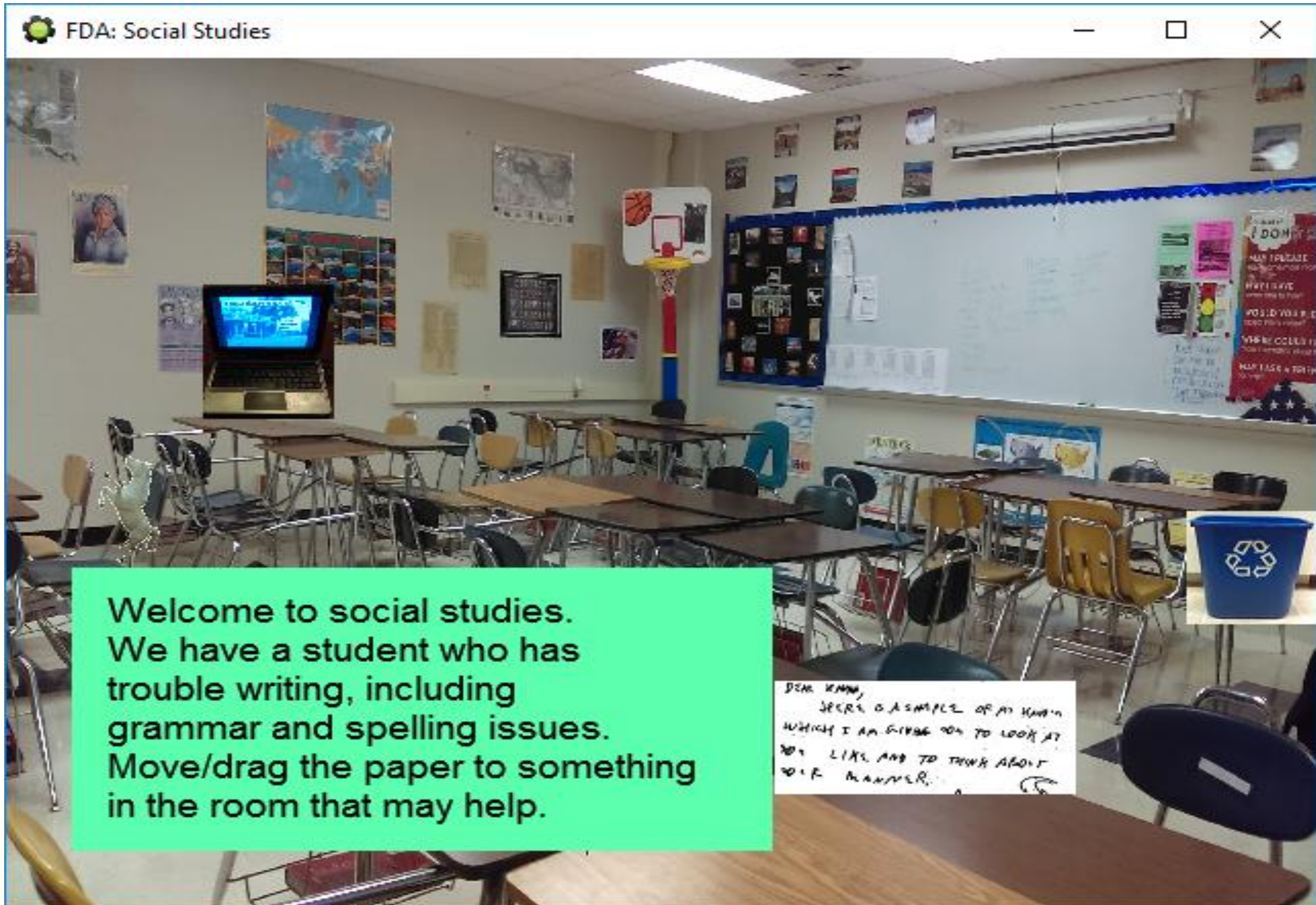
English- Dyslexia

Social Studies- Dysgraphia

Bus to go home

Data - 69 Subjects

○ Took a pretest (14 questions)
○ Played the game (15-25 minutes)
○ Took a posttest (14 questions)
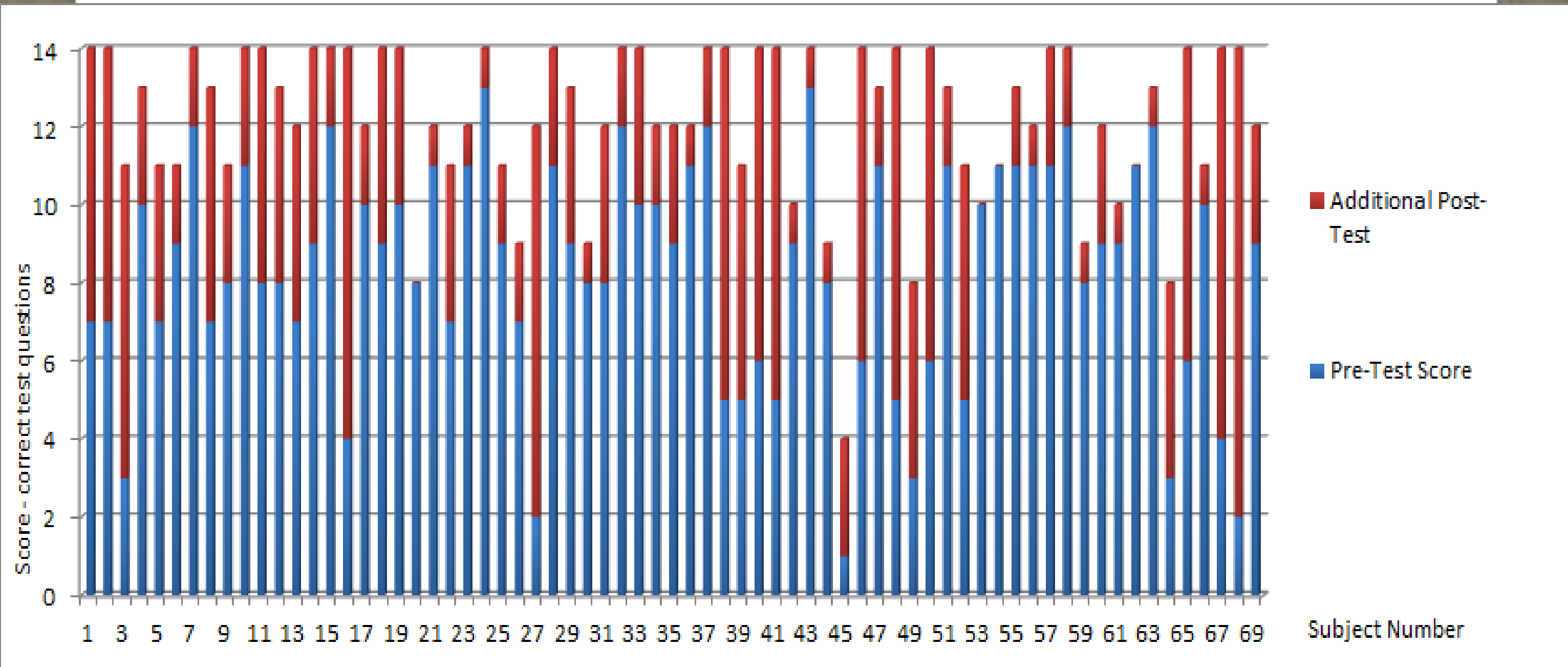
Data Summary

	Average	Range
Age - years	21.72	12-63
Pre-test /14	**8.32**	1-13
Pre-test %	59.42	7-93%
Post-test /14	**12.19**	4-14
Post-test %	86.65	29-100
Raw difference	3.87	0-12
% increase	77.36%	0 - 600%

Histogram - Pre-Test

Histogram - Post-Test
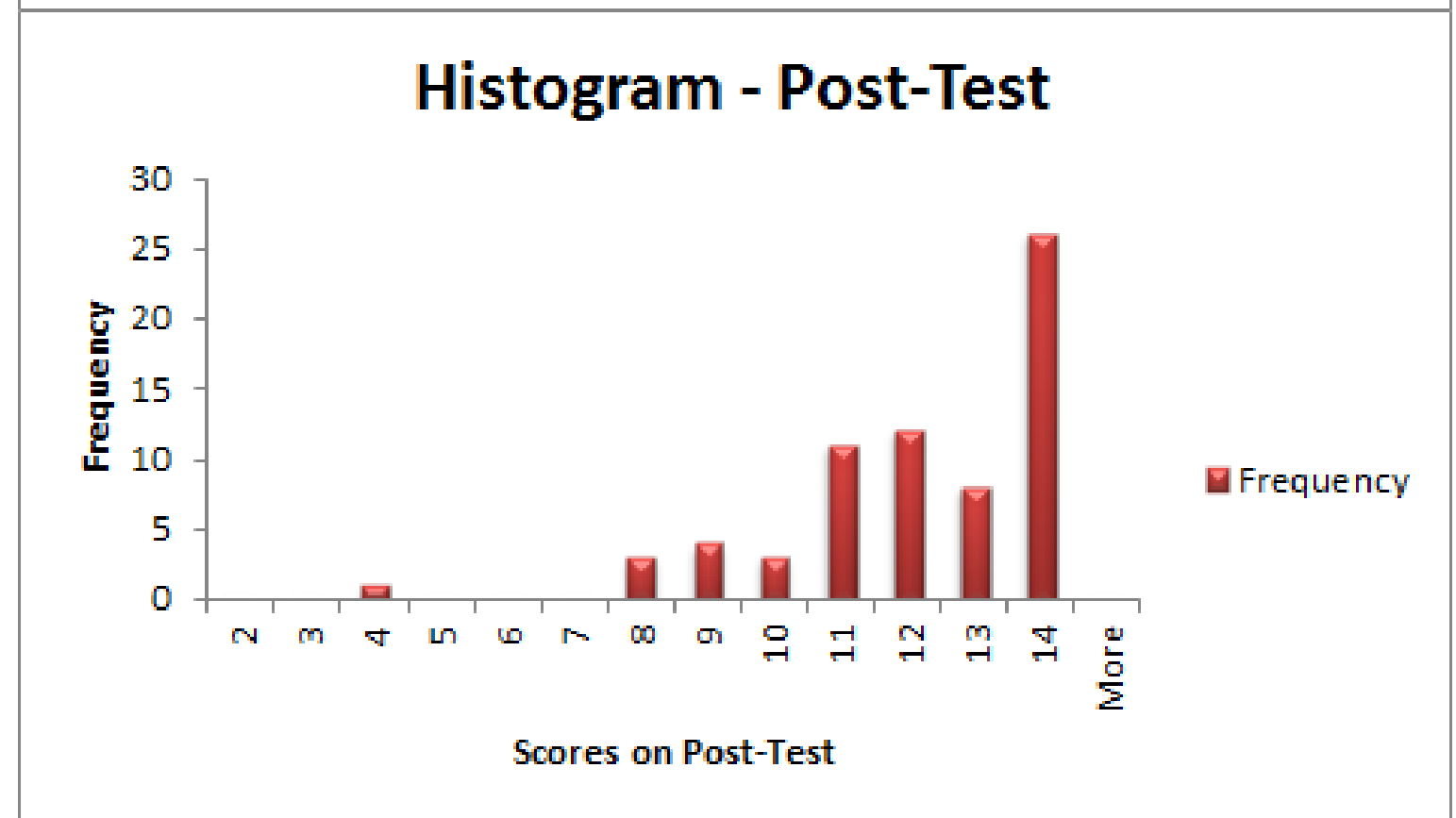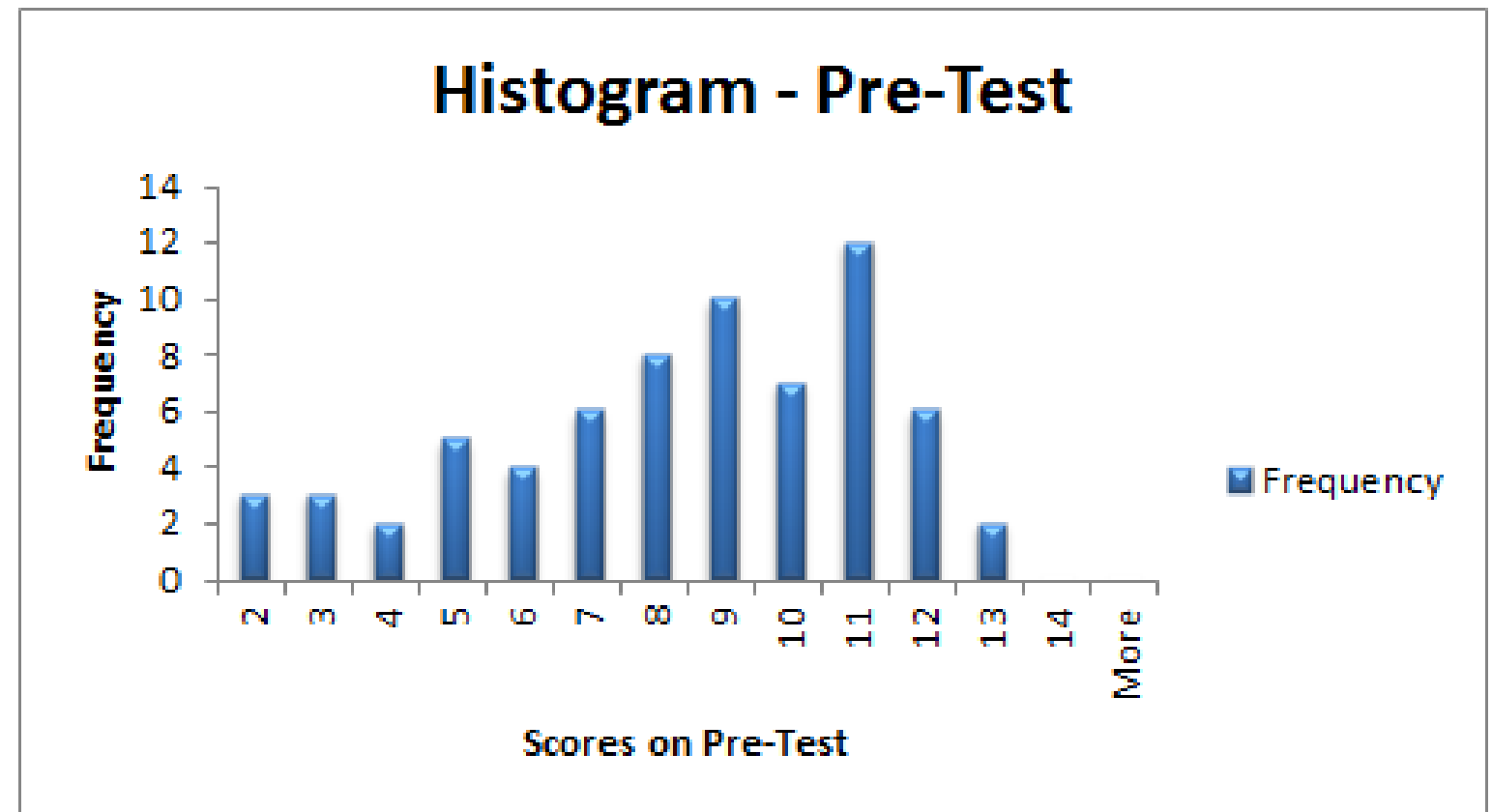
Comparing Questions/Facts

Disability	Class-room	Characteristic/ helped by	Activity	Pretest % correct	Posttest % correct
ADHD	Science	Hard to focus; Easily distracted	Read	**95**	97
		Chunk information, take breaks	Select 4 boxes	61	97
Asperger's	Computer	Trouble in social situations	Read	79	97
		Keep routine, visual	Select computer	62	89
Autism	Library	Act out of turn, not respond	Collide object	81	89
		Have rituals, space to calm	Read	67	93
Dyscalculia	Math	Difficulty with math facts	Read	61	89
		Use calculator, graphing paper	Select 2-4 objects	48	87
Dysgraphia	Social studies	Trouble writing, spelling, grammar, usage	Read	30	61
		Write small chunks, Word	Drag paper	18	57
Dyslexia	English	Mixes up letters, reading troubles	Read	90	91
		Use auditory support	Collide with book	79	80
Physical	Gym/PE	Wheelchair- ask if can help	Find glasses	85	97
% in schools with disabilities	Office	About 13% US public school	Read	**21**	**98**

Data Analysis

- Average scores went from 8.32/14 **(59%)** on the **pre-test** to 12.19/14 **(87%)** on the **post-test**.

- The difference of the participants scores was statistically significant
  - Paired t-test one-tail **P-value of 1.3 x 10^{-16}.**

- Item Analysis
  - The fact that participants <u>most improved</u> on
    - ~ **13% of U.S. public school students have some disability** (from **21%** correct on the pre to **98%** on post).
  - The fact <u>least known</u> by subjects
    - ~ **someone with dysgraphia can be helped by writing in small chunks and using a word processor** (18% correct on pre).
  - The fact that was <u>most known </u>already
    - ~ **someone who has ADHD has a difficult time focusing and is easily distracted** (95% correct on pre)

Conclusion

- There is less than one in a trillion chance that the null hypothesis (H2) is true.
    - Null hypothesis (H2): People cannot learn about disabilities from playing an educational computer game.
- The hypotheses were correct that
    - (H1) **An educational computer game can be made to present information about disabilities.**
    - (H2) **People can learn from playing an educational computer game about disabilities.**

- Issues
    - Some teachers and psychology students knew too much already. We did not use subjects who were teachers or psychology majors.
    - Some subjects seemed not to be taking the tests seriously although their test results were included.

Further Studies/Applications

- Expand on the computer game with more activities that the participants can do to be more fun and go deeper
  - Simulate
    - ADHD, autism, dyscalculia, dysgraphia, dyslexia
- Give another post-test days or weeks later
- Add to the computer game
  - Mental disorders
  - Physical disabilities
  - Other settings/environments
  - Additional game goals
  - Sounds

- Participants may be able to
  - Take what they have learned and apply it to the real world
    - **Help someone with a learning disability**
    - **Be more understanding towards someone with a disability**

References / Questions?

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