Development of Multimedia

User Interface Design (COMP1650)

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Contents

1. Introduction

The aim and the objective of this project are to evaluate three online math's games that are suitable for children aged between 5 and 7 years. Through the principles and standards from people of Nielsen and Shneiderman, the evaluation is helpful to understand how effective of three games is and how to use factors like font, layout, sound and animation in user interface. After researching three games, summary the advantages and disadvantages of them to create new standards and guidelines for new math's game.

2. Literature Review

This section will be a research and of existing principles and standards which help to identify the problems in user interface and also help to create a good website/game. From the evaluation of three games, I can summarize the advantages and use this to design a new math's game.

2.1. Usability and Accessibility

Usability and Accessibility are two different part but they have related to qualities strongly. Usability refers to make sure that player can figure how to play easily and Accessibility is to make sure that everyone can play game even disabilities people.

W3C helps to set standards for creating a usable and accessible website:

- Provide equivalent alternatives to auditory and visual content
- Don't rely on color alone
- Ensure user control of time-sensitive content changes
- Ensure direct accessibility of embedded user interfaces
- Design for device-independence
- Provide context and orientation information
- Provide clear navigation mechanisms

2.2. Nielsen's Heuristic

Heuristic helps to identify problems related to the usability of the design of user interface. The set of heuristics are still used today. There are 10 principles:

- Visibility of system status
  The system will provide users feedback and information to help users know what is going on with the reasonable time.
- Math between system and the real world
  Provide users information which is easy to understand such as words, phrases, concepts should be familiar to users.

- User control and freedom
  Users can often make mistakes in picking wrong functions and system will need to support function like undo or redo to help user escape the unwanted state without going to an extended dialogue.

- Consistency and standards
  The process should be consistent in the same situations or actions so that users do not have confused while using the system.

- Error prevention
  Always check the design and system to control problems before they appear.

- Recognition rather than recall
  Using familiar icons, objects and actions to reduce the user's memory load so that they do not have to remember each state or from one screen to another. Instructions should be clear and easy to understand.

- Flexibility and efficiency of use
  The system can be used by novice and expert users in easy and efficient way.

- Help user recognize, diagnose, recover from errors
  Always use clear error messages (no codes) which help users to understand problems, and may be guide them how to recover from the errors

- Help and documentation
  It should be better if system can be used without instructions, but sometimes help and documentation are necessary. However, information should be easy to follow so users can know what to do.

2.3. Shneiderman's Eight Golden Rules

This is a guide to good interaction design.

- Strive Consistency
  Keep consistency on using prompts, menus, icons, help screens and actions of similar situations.

- Enable frequent users to use shortcuts

Shortcuts are used more frequently to speed up the pace of interaction. Abbreviations, function keys, hidden commands, and macro facilities are very helpful to an expert user.

- Offer informative feedback
  There should be some system feedback for every operator action. For frequent and minor actions, the response can be modest, while for infrequent and major actions, the response should be substantial

- Design dialogue to yield closure
  Sequences of actions should be organized into groups with a beginning, middle, and end. The informative feedback at the completion of a group of actions gives the operators the satisfaction of accomplishment, a sense of relief, the signal to drop contingency plans and options from their minds, and an indication that the way is clear to prepare for the next group of actions.

- Offer simple error handling
  The system should be tested carefully so that users cannot make serious errors.

- Permit easy reversal of actions
  This feature relieves anxiety, since the user knows that errors can be undone; it thus encourages exploration of unfamiliar options. The units of reversibility may be a single action, a data entry, or a complete group of actions.

- Support internal locus of control
  Users want to the system as they can control it and the system responds to their actions.

- Reduce short-term memory load
  Keep the interface simple so users do not have to remember when they change from one screen to another.

2.4. User Interface Design

2.4.1. Content and Layout

Content layout is very important part because a good design layout helps users interact smoothly with game/websites. There are some principles in designing website like using golden ratio, grid view, list view… However, game layout is a bit different from web layout because it depends on game content, animation, OS platform and screen size. These are some points:

- Screen resolution and screen size
- Platform design conventions
- Consistent visual identity
- Present message efficiently and avoid clutter
- Draw attention to new or greatly changed content
- Avoid requiring the use of horizontal scroll bars
- Use top and left areas of the screen for navigation and identity

2.4.2. Font and Color

Color helps indicate interactivity and provide visual continuity. And all text should be always legible, help users to get information easily. Sometimes we can use multiple custom colors but make sure they work well together. In game for children, color helps to attract them for example a colorful character can be more noticed than a black and white character. Avoid using the same color for active and inactive elements because users will confuse where to tap. For font, make sure all styles of a custom font are easy to read at different size and designer should use a consistent font in one application. For example:

It's easier to read and feel better on the left image than the right image.

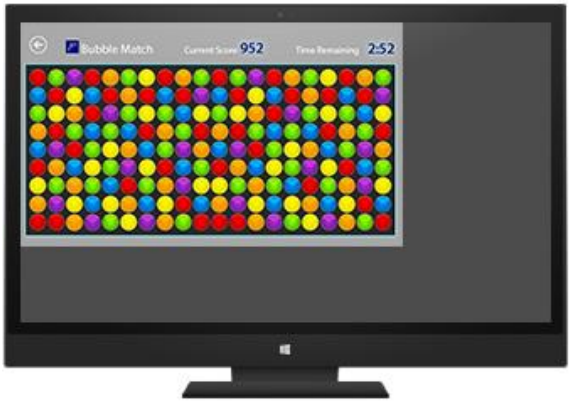
2.4.3. Icon

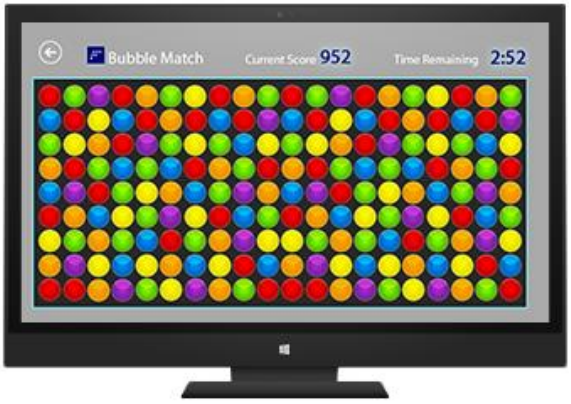
Icon plays an important role to remind users of something. The use of icon will help users easy to remember, sometimes users just see the icon and they recognize what the function is.

For example: We both recognize these icons above stand for Message, Mail, Calendar, Camera, Movie, and Music.

2.4.4. Screen size

There are a lot of smart devices with different screen sizes and the game should be look good at any window sizes or screen sizes. Automatic support for landscape and portrait orientations is really good. However, some games are look better in landscape mode and therefore, portrait mode should be locked. And the game should be displayed on full screen size.





2.4.5. Sound

Sound in a game is quite important because it can change the effects the sound have on player. It also creates the atmosphere for a game. For example in horror games, sound always makes player feel scared and in funny games, music makes players feel happy. However, games should have function turn on or turn off the sound because sometimes it could be very annoying.

2.4.6. Animation

Animation also contributes in the success of a game. Players are attracted by the combination of animation and sound. The use of animation is better than static image.

2.5. Criteria

Through the literacy review, I will evaluate three math's online game and base on these criteria to design my new game:

1. Match between system and the real world
2. User control and freedom
3. Recognition rather than recall
4. Flexibility and efficiency of use
5. Help and documentation
6. Visibility of system status
7. Strive Consistency
8. Reduce short-term memory load
9. Platform design conventions
10. Avoid requiring the use of horizontal scroll bars
11. Use top and left areas of the screen for navigation and identity
12. Consistent visual identity
13. Provide equivalent alternatives to auditory and visual content
14. Don't rely on color alone
15. Design for device-independence
16. Provide clear navigation mechanisms
17. Font should be legible and consistent
18. Display on full screen mode
19. Using animation to convey message
20. Using sound to create the atmosphere in game

3. Requirement Specifications

3.1. Scenario

Online games are very popular, some of them are designed to help children develop their skill and ability in different areas like math's, music and science. Evaluate three online maths games suitable for children aged between 5 and 7 years old and create a new maths game for this age group. There are a lot of smart devices with different screen size so design this game to fit on mobile phones or comparable devices.

3.2. Objectives

- Review literacy review
- Determine target audience
- Choose 3 existing games to analyze and evaluate
- Create 3 low level prototypes
- Choose 1 prototype and develop high level prototype, build an interface
- Evaluate the interface against criteria
- Evaluate how the design would adapt to the wide range of screen sizes

3.3. Target Audience

3.3.1. Parents

Parents are the owners of smart devices so they can determine which games they can allow their children to play, they will be the ones who can control what kind of software in the device. In some case, they can pay for software if it helpful and suitable for their children. The game content should be made simple and helpful because parents do not impressed in graphical animation.

3.3.2. Children

Children are the key group that this game is aimed to. From age between 5 and 7, there are a lot of things that children want to explore in life and the good things will help them to develop their bodies and minds. At this age, children like graphics, colorful scenes, animation which really attract them.

4. Evaluating existing games

4.1. Game 1

Count to 100 - http://www.primarygames.com/math/countto100/

This game is for children aged between 5 and 7 with good observation. They have to find the digits from 1 to 100 ascending.

Home Screen

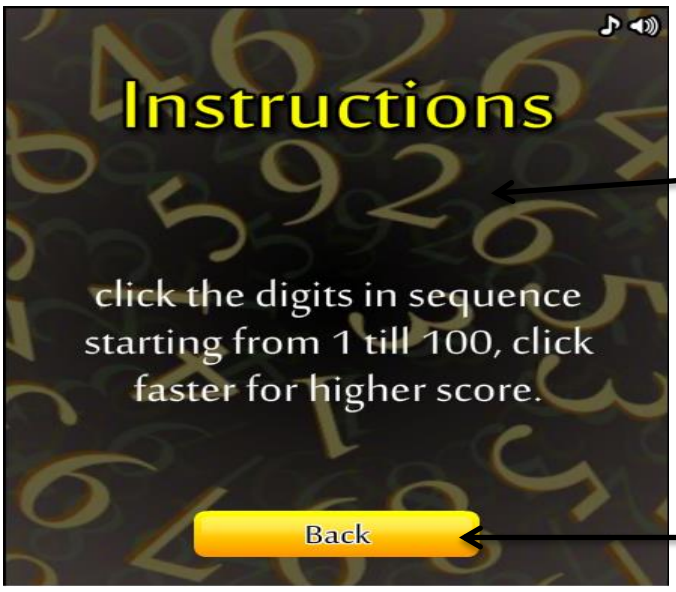
Have turn on and turn off sound

Have clear name of the game, using background

Have options for user to choose

Different level to play: 5x5, 7x7, 9x9, 10x10

Instructions Screen



Instructions page use the same background with home page, it's not clear to read

"Back" button to navigate to home page

Play Screen

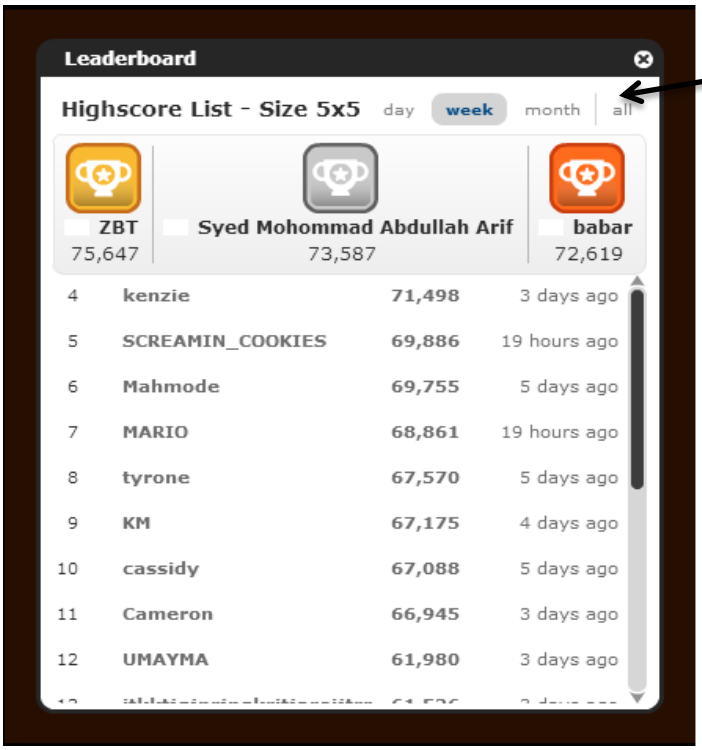
Navigate to Main Menu

Users know about their Score

Hint for user to find what number is next

Time to measure how long user finishes this

Leaderboard Screen



The Leaderboard show the highest score in group: day, week, month of this level

Using my criteria to evaluate this game:

1. Match between system and the real world
   - Game use English and has clear instruction
2. User control and freedom
   - User is free to quit game, back to the main menu
3. Recognition rather than recall
   - No icon at all
4. Flexibility and efficiency of use
   - All children can play this game and the score will let them know how fast they are
5. Help and documentation
   - Using instructions
6. Visibility of system status
   - When user play game, system keep respond with time and score
7. Strive Consistency
   - The game keeps consistency on font, background and button
8. Reduce short-term memory load
   - The interface is simple for users to follow
9. Platform design conventions
   - No conventions
10. Avoid requiring the use of horizontal scroll bars
    - No use of horizontal scroll bars
11. Use top and left areas of the screen for navigation and identity
    - Also use top area for menu
12. Consistent visual identity
    - Achieve this
13. Provide equivalent alternatives to auditory and visual content
    - No alternatives
14. Don’t rely on color alone
    - Just use some main colors: black, white, yellow
15. Design for device-independence
    - Just design for web
16. Provide clear navigation mechanisms
    - All screens have function back to main screen
17. Font should be legible and consistent
    - The Instructions is not really clear
18. Display on full screen mode
    - No full screen mode
19. Using animation to convey message

- Bad animation of background

20. Using sound to create the atmosphere in game
    - Using sound and have function to turn on and turn off sound

4.2. Game 2

Math Hurdle - http://www.primarygames.com/math/mathhurdles/

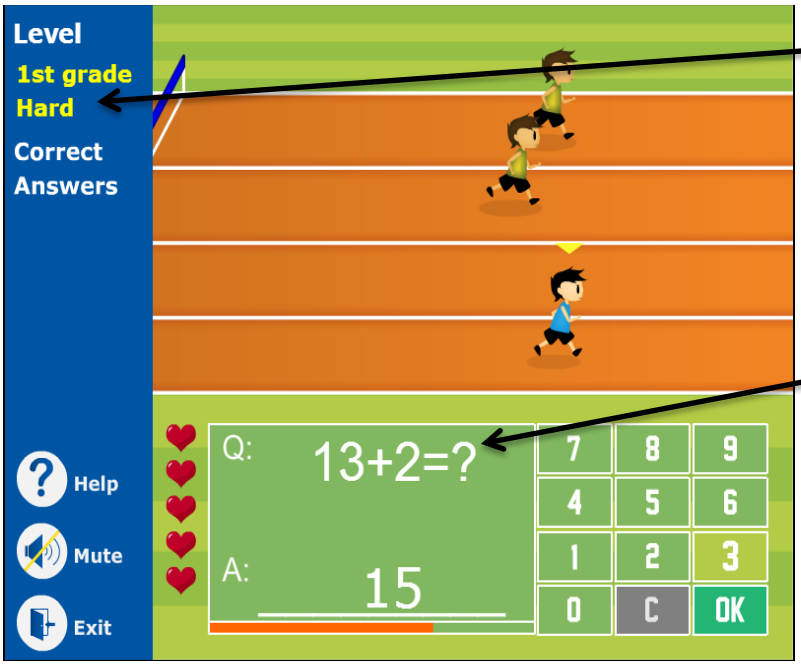
Answer simple math questions to jump hurdles. A fun math's game which is suitable for children from 6 – 8.

Home Screen

Have nice background with different fonts. It has character on the background.

It's clear to view the name of game

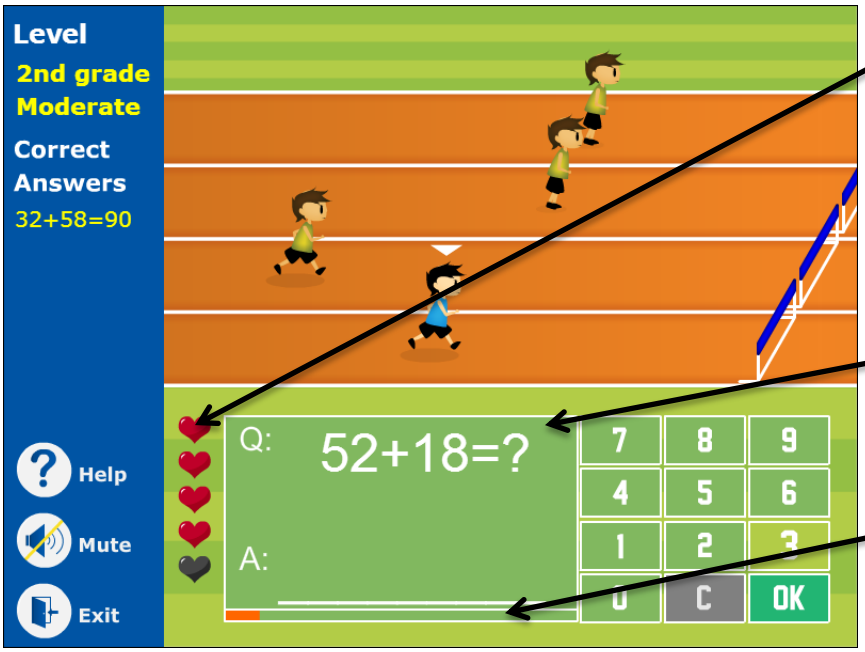
Play Screen 1



Have different level in game play

At first, user can do math with easy operations

Play Screen 2

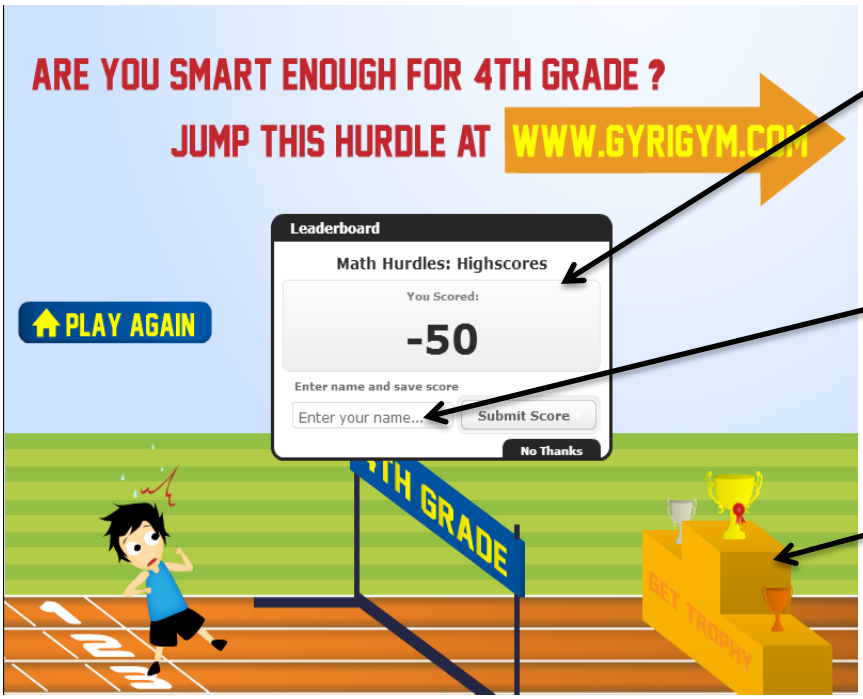


Users have 5 times to miss or wrong answer.

Then the difficulty of operation keep increasing

Time progress for each question

Result Screen

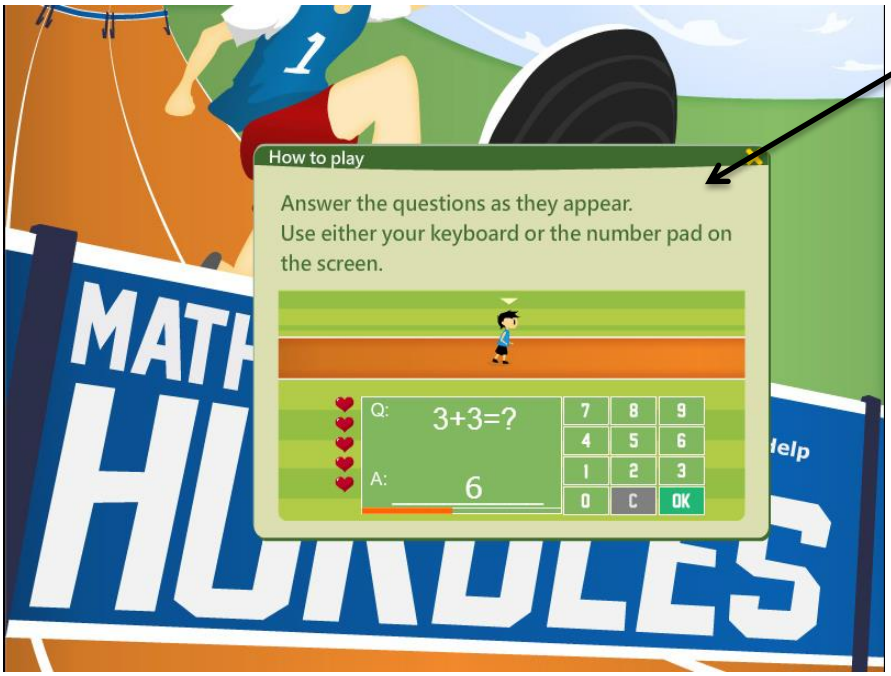


Show the high scores after finish game

Users can choose play again or submit their scores

Background with cups is quite interesting

Instruction Screen



Background, font color are clear, help users find easy to read

Using my criteria to evaluate this game:

1. Match between system and the real world
   - Game use English, has help and instructions
2. User control and freedom
   - User is free to control any state of the game
3. Recognition rather than recall
   - Use some icons like Help, Play, Exit.
4. Flexibility and efficiency of use
   - Novice and expert can also play this game and the level is shown in result
5. Help and documentation
   - Clear Instructions with text and image
6. Visibility of system status
   - When user play game, system keep respond with time progress and score
7. Strive Consistency
   - The game keeps consistency on font, background and button
8. Reduce short-term memory load
   - The interface is simple for users to follow
9. Platform design conventions
   - No conventions
10. Avoid requiring the use of horizontal scroll bars
    - No use of horizontal scroll bars
11. Use top and left areas of the screen for navigation and identity
    - Also use left area for menu
12. Consistent visual identity
    - Achieve this
13. Provide equivalent alternatives to auditory and visual content
    - No alternatives
14. Don’t rely on color alone
    - Achieve this
15. Design for device-independence
    - Just design for web
16. Provide clear navigation mechanisms
    - Navigation is clear and easy to follow
17. Font should be legible and consistent
    - Text is easy to read
18. Display on full screen mode

- No full screen mode

19. Using animation to convey message
    - Animation is good to show if user answer right or wrong
20. Using sound to create the atmosphere in game
    - Use sound and have function to turn on and turn off sound

4.1. Game 3

Mathepillar - http://www.primarygames.com/math/mathepillar/

Mathepillar is an outrageously fun game in which players have to order falling numbers on a number line by positioning their caterpillar in the correct place to catch the numbers. There are four stages to the game, and each stage presents a slightly more complicated number line or pattern. If a player can pass all four stages, he or she can print out one of six limited edition butterfly certificates, each featuring a different species of butterfly.

Home Screen

Have colorful background with character.

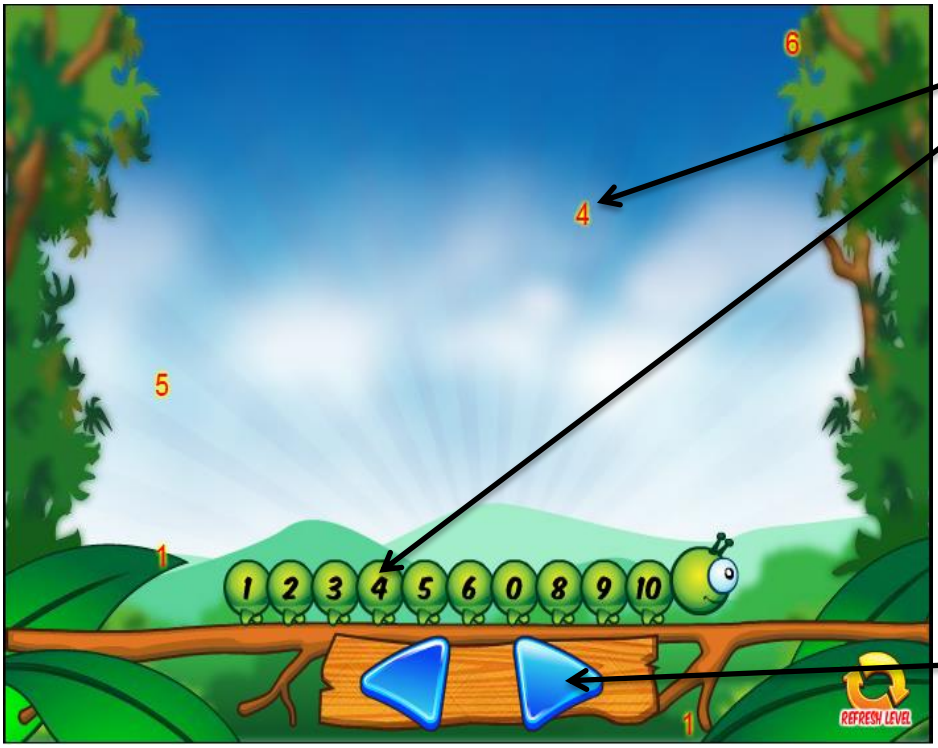
Use special font for the name of game. It's clear and easy to read

Play Screen 1

Users will start from level 1 and have the instruction for each level

Users can refresh level to start play this level again

Play Screen 2



Users have to catch the number, put in the right place as the instruction

Users can use button “left” and “right” or use the arrow on keyboard

Result Screen

If users put the number in wrong place then they lose the game and have to play this level again

If users complete 6 level then they users win the game

Using my criteria to evaluate this game:

1. Match between system and the real world
   - Game use English, has instructions
2. User control and freedom
   - User is free to control any state of the game
3. Recognition rather than recall
   - Use both icon and text
4. Flexibility and efficiency of use
   - Not achieve this
5. Help and documentation
   - No help
6. Visibility of system status
   - When user play game, system keep respond with the move of character
7. Strive Consistency
   - The game keeps consistency on font, background and button
8. Reduce short-term memory load
   - The interface is simple for users to follow
9. Platform design conventions
   - No conventions
10. Avoid requiring the use of horizontal scroll bars
    - No use of horizontal scroll bars
11. Use top and left areas of the screen for navigation and identity
    - Not achieve this
12. Consistent visual identity
    - Achieve this
13. Provide equivalent alternatives to auditory and visual content
    - No alternatives
14. Don’t rely on color alone
    - Has colorful character and nice background
15. Design for device-independence
    - Just design for web
16. Provide clear navigation mechanisms
    - Navigation is clear and easy to follow
17. Font should be legible and consistent
    - Achieve this
18. Display on full screen mode

- No full screen mode

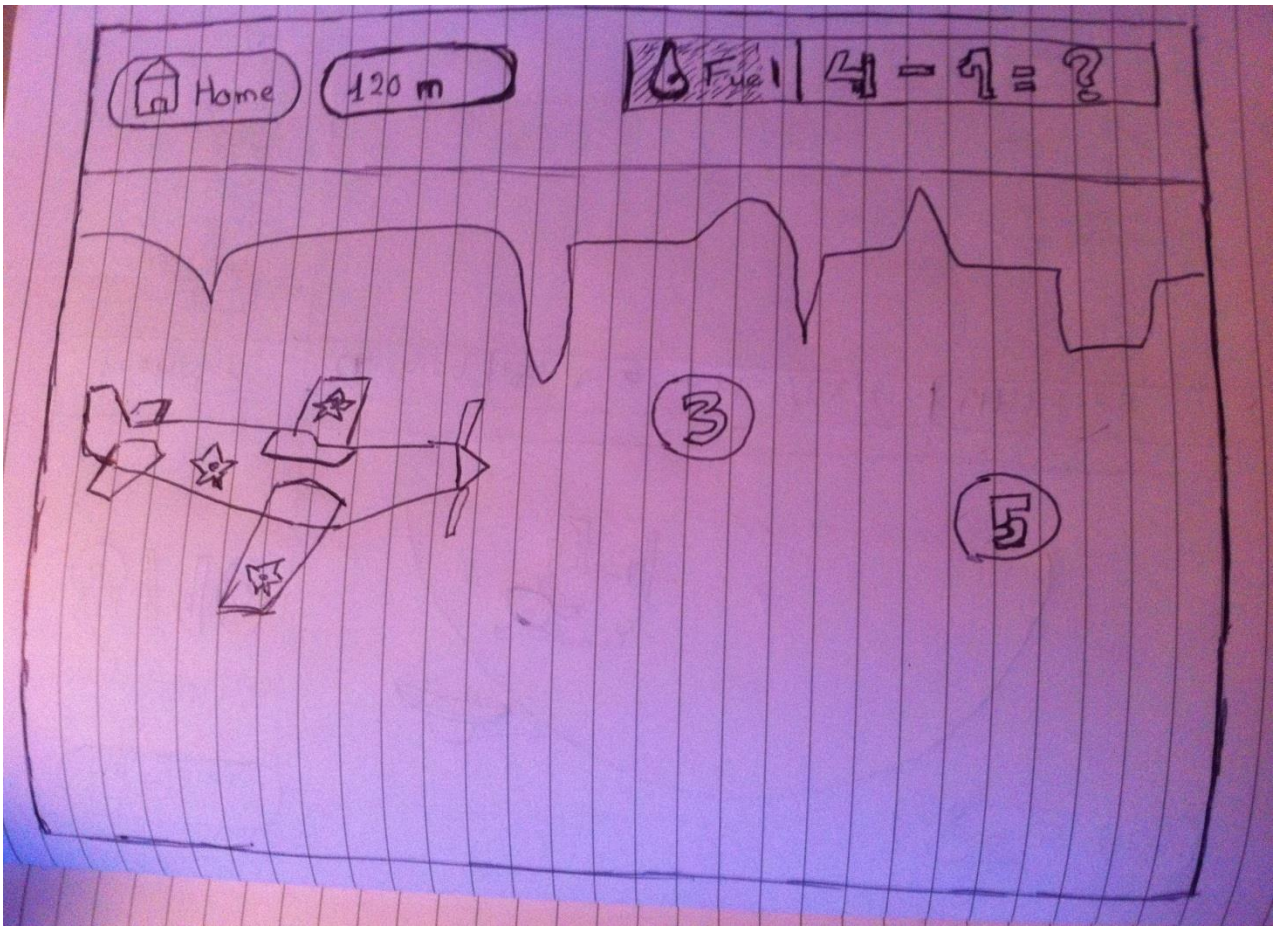
19. Using animation to convey message
    - Animation is good to show when user finishes each level
20. Using sound to create the atmosphere in game
    - Use sound but have no function to turn on and turn off sound

4.4. Conclusion on Evaluation

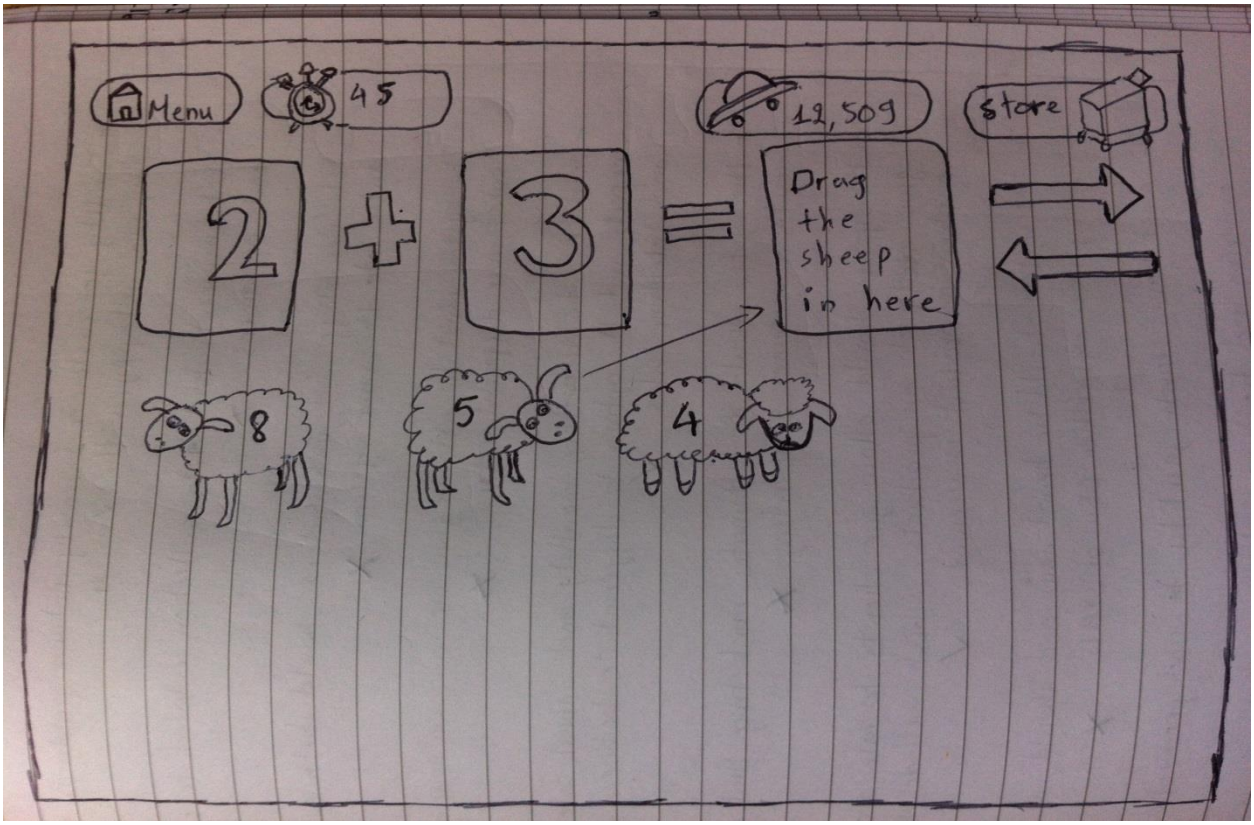
After evaluating 3 math's game, I have been convinced that game 2 is the best one because the game play is good, has clear instructions. It has consistent elements like background, button and font. And players feel that they have competition in game through the combination of time progress and animation. In contrast, game 1 is the worst game because it has no use of icon, instructions is not easy to read as the animation of background makes players feel like their heads are turning round and round.

5. Design

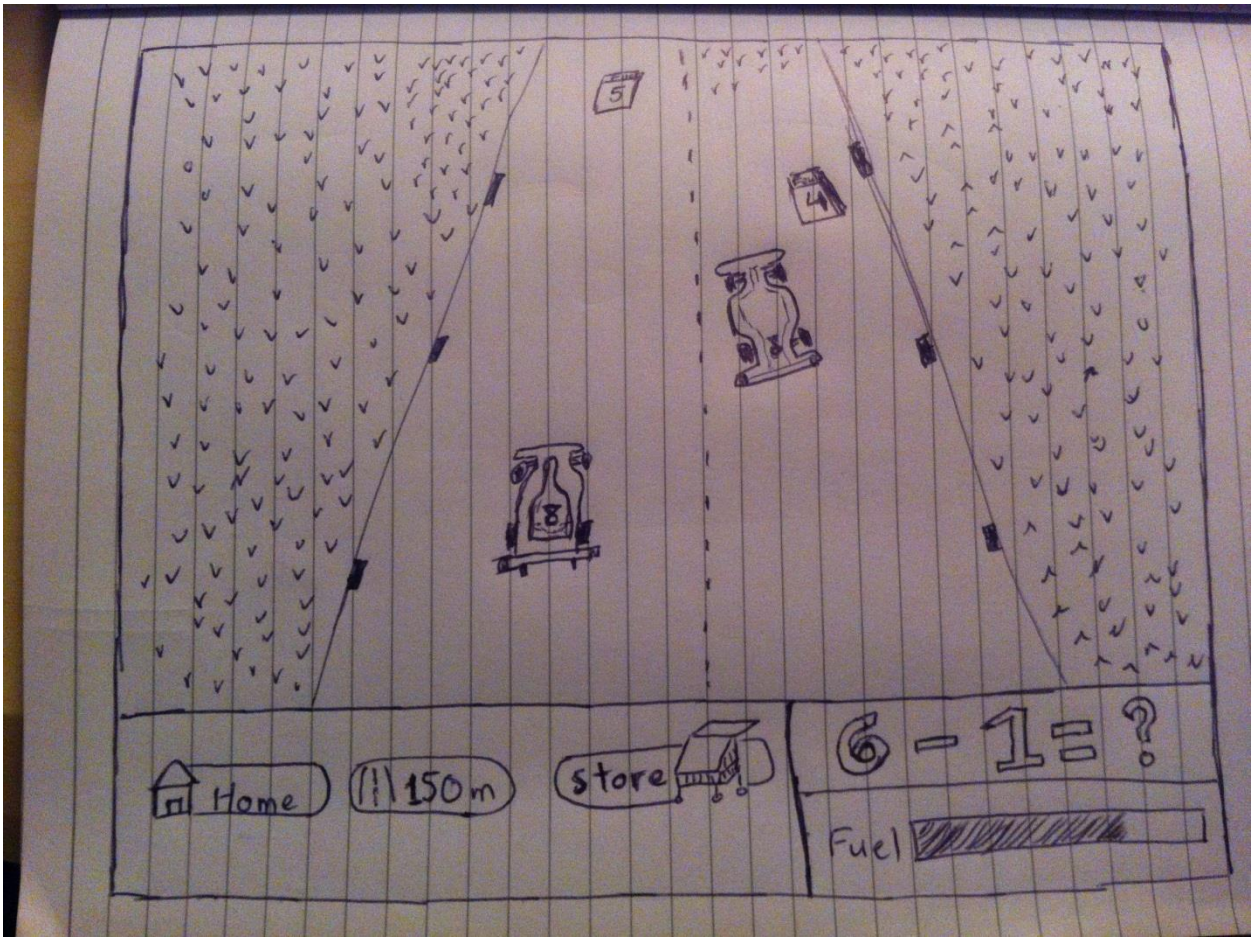
5.1. Low level prototype 1



5.2. Low level prototype 2



5.3. Low level prototype 3



6. Development/Implementation

Choose low level prototype 2 to develop high level prototype.

6.1. Layout and Content

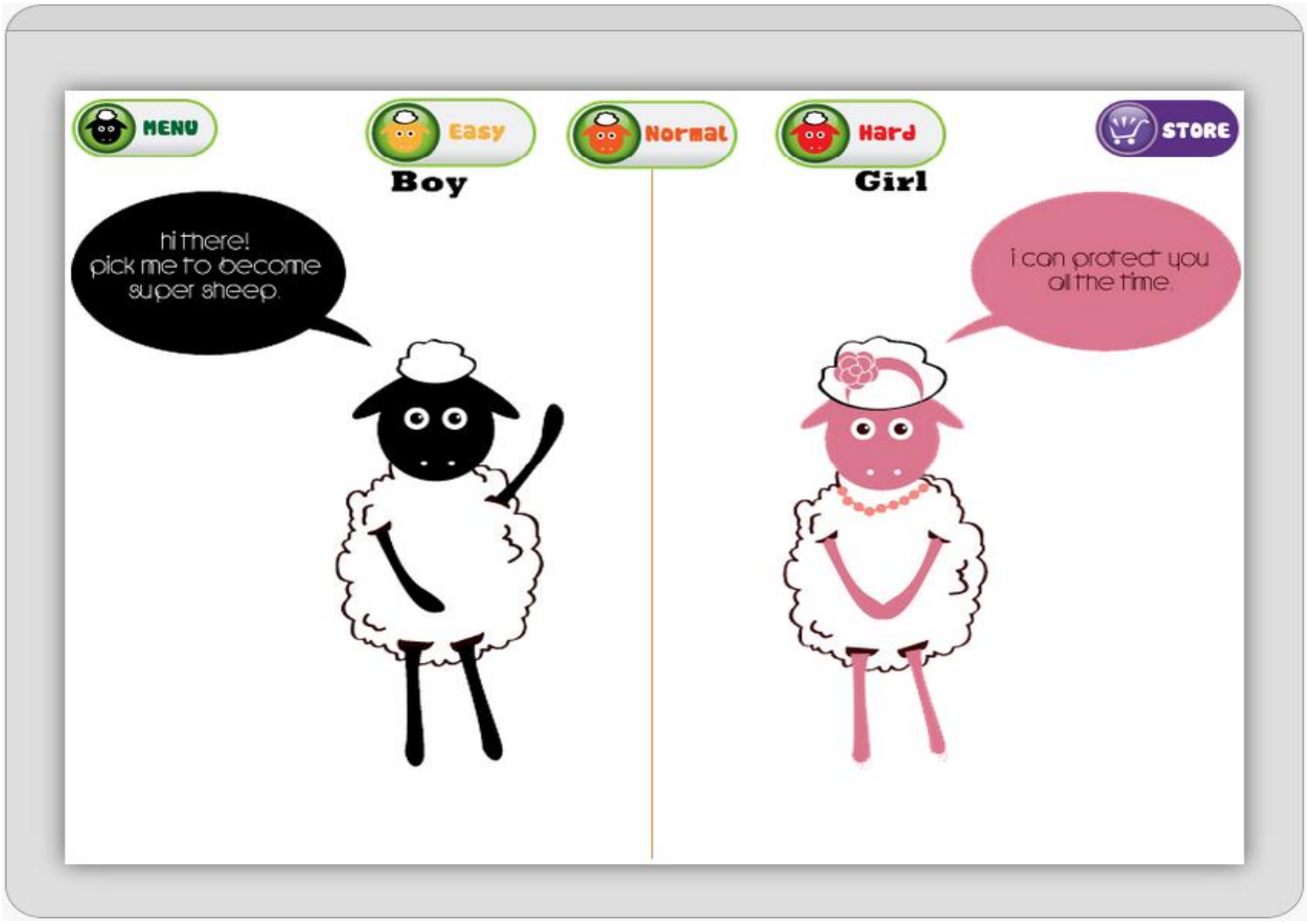
The main screen for user to play spreads to full screen of the device. The background contains sheeps for user to choose and drag in the red rectangle to answer the question. There are 2 buttons at the top screen which are Menu and Store and these 2 elements are consistent in game screens. And 2 textboxes are used to show time and score. The arrow will help player move to the next question or back to the previous question.

6.2. Screens

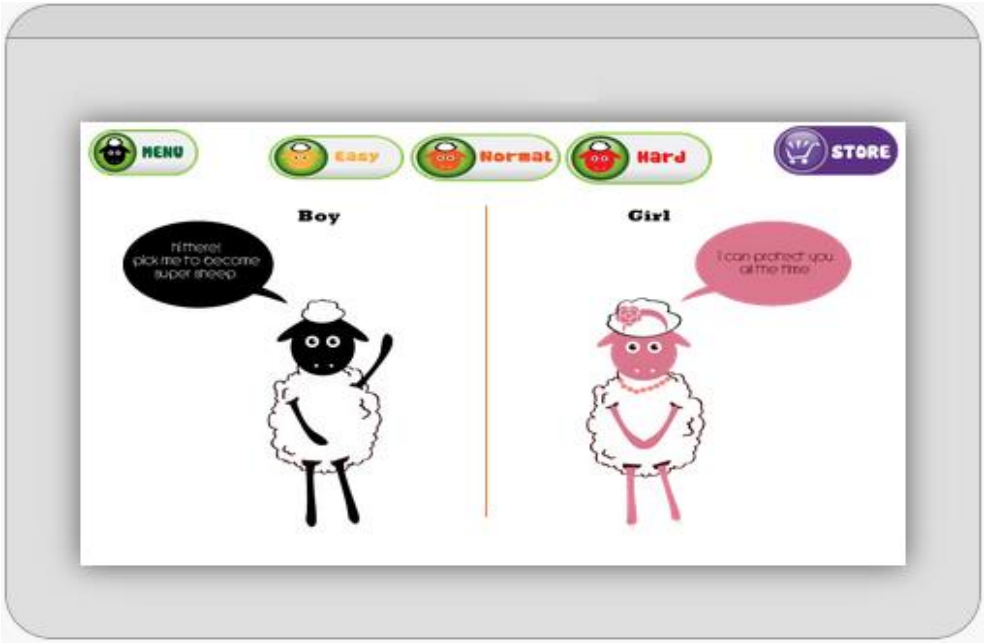
Menu Screen (iPad and iPad mini)

Main screen (iphone)

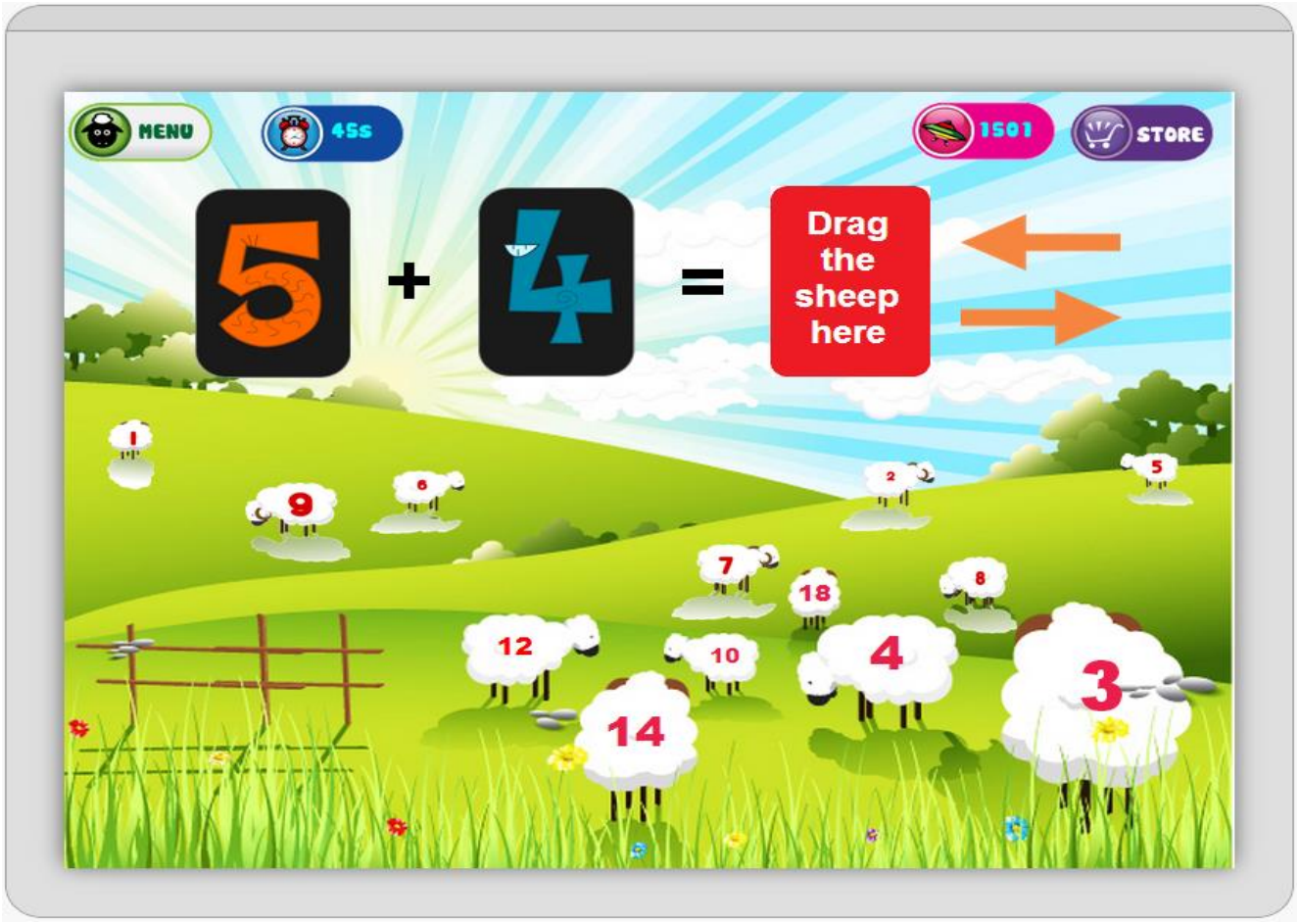
Character and Level Screen (iPad and iPad mini)



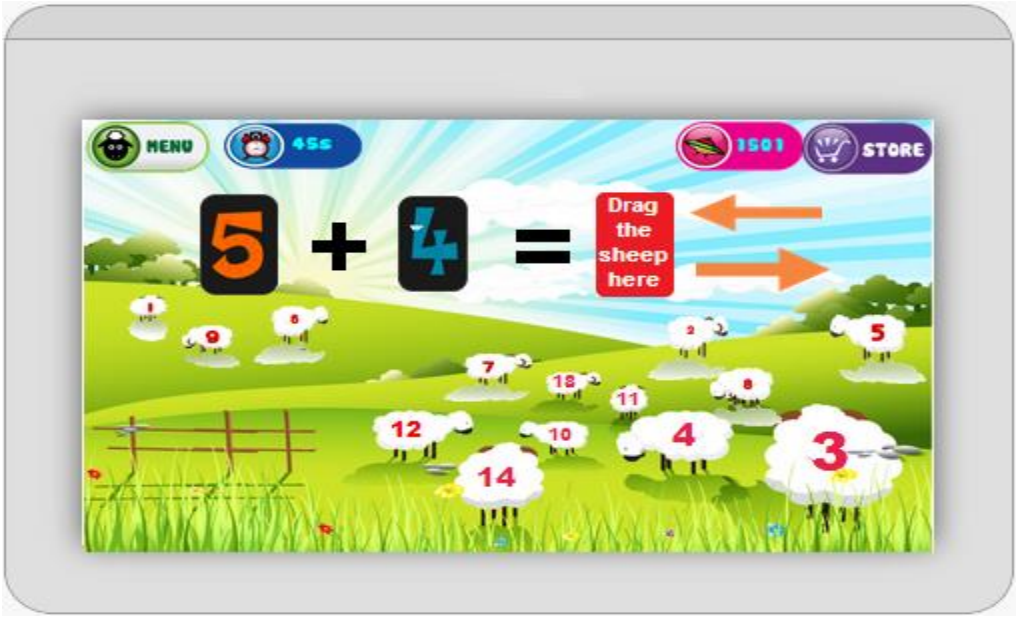
Character and Level Screen (iphone)



Play Screen (iPad and iPad mini)



Play Screen (iphone)



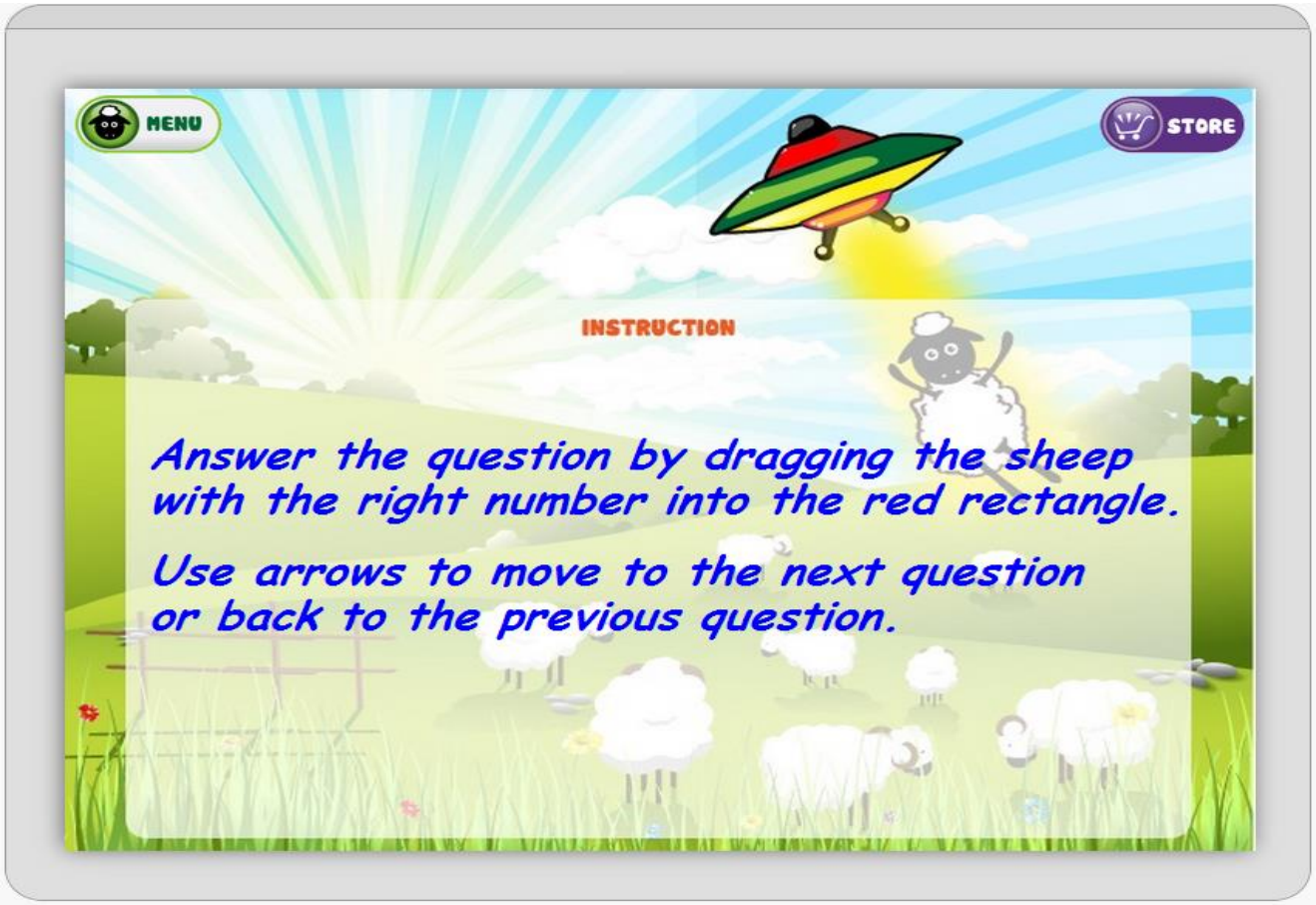
Result and Store Screen 1 (iPad and iPad mini)

Result screen (iphone)

Result and Store Screen 2 (iPad and iPad mini)

Store screen (iphone)

Instructions screen (iPad and iPad mini)



Instructions screen (iphone)

6.3. Scenario

6.3.1. Play and win the game

- Step1: Access the game and click on **Play**
- Step2: Choose level and character
- Step3: Answer questions in given time
- Step4: There will be a dome appear to protect the farm, UFO will be crashed when it touches the dome

6.3.2. Play and lose the game

- Step1: Access the game and click on **Play**
- Step2: Choose level and character
- Step3: Answer questions in given time
- Step4: UFO will come to catch the sheep

7. Evaluation

This high level prototype will be evaluated by the criteria above.

1. Match between system and the real world
   - Game use English, has instructions
2. User control and freedom
   - User is free to control any state of the game play, user can back to the main menu any time to choose the character again.
3. Recognition rather than recall
   - Use both icon and text
4. Flexibility and efficiency of use
   - There are 3 levels for all users to play:
      + Easy: This level contains operations between number with 1 character and number with 1 character. For example: 9 – 5 = ?
      + Normal: This level contains operations between number with 1 character and number with 2 characters. For example: 7 + 13 = ?
      + Hard: This level contains operations between number with 2 characters and number with 2 characters. For example: 39 – 15 = ?
5. Help and documentation
   - The game is so simple that users can play without any help or documentation
6. Visibility of system status
   - When user play game, system keep respond with the move of character, time, result, and the change of characters when they buy things in Store.
   - The image appears on result screen will be ‘Congratulation’ if users win the game and ‘Sorry! Try again’ if users lose the game
7. Strive Consistency
   - The game keeps consistency on font, background and button
8. Reduce short-term memory load
   - The interface is simple for users to follow
9. Platform design conventions
   - This game is designed for iphone, ipad and ipad mini.
10. Avoid requiring the use of horizontal scroll bars
    - No use of horizontal scroll bars
11. Use top and left areas of the screen for navigation and identity
    - All the buttons are kept on the top
12. Consistent visual identity
    - Achieve this

13. Provide equivalent alternatives to auditory and visual content
    - No alternatives
14. Don't rely on color alone
    - Has colorful character and background to attract children
15. Design for device-independence
    - Design for iOS device
16. Provide clear navigation mechanisms
    - Navigation has buttons with icons that help users see to follow
17. Font should be legible and consistent
    - All the button use font UTM-Cookies
18. Display on full screen mode
    - Always on full screen mode
19. Using animation to convey message
    - Animation shows each time when users play and finish the game
        + If users choose 'boy character' and win the game: the result screen will show the animation that UFO is shot by some lightning. The sheep will be protected.
        + If users choose 'girl character' and win the game: the result screen will show the animation that a dome appears to protect the sheep and UFO has been crashed when it touch the dome.
        + If users lose the game: UFO will catch the sheep of users.
20. Using sound to create the atmosphere in game
    - Use sound in game

21. Design game adapt to the wide range of screen sizes
    - All the screens in the game will be displayed in full screen mode on iPad, iPad mini and iphone.
    - Break result screen on iPad into 2 screen as result screen and store screen on iphone

8. References

Websites

Shaun the Sheep Wiki. [Online]
Available at: http://shaunthesheep.wikia.com/wiki/List_of_characters.
Last Accessed: 23rd November 2013

Primary Games. [Online]
Available at: http://www.primarygames.com/
Last Accessed: 24th November 2013

Dev Center – Windows Store apps. [Online]
Available at: http://msdn.microsoft.com/en-us/library/windows/apps/hh465349.aspx
Last Accessed: 21st November 2013

iOS Human Interface Guidelines: Designing for iOS 7. [Online]
Available at: https://developer.apple.com/
Last Accessed: 21st November 2013

Game Design 2: UI Layout. [Online]
Available at: http://www.slideshare.net/unthank/game-design-2-ui-layout
Last Accessed: 21st November 2013

Fluid. [Online]
Available at: https://fluidui.com/
Last Accessed: 2nd December 2013

W3C. 2011. Themes of Accessible Design. [Online]
Available at: http://www.w3.org/TR/WCAG10/#themes
Last Accessed: 21st October 2013

Online Journals/ Articles

10 Usability Heuristics for User Interface Design. [Online]
Available at: http://www.nngroup.com/articles/ten-usability-heuristics/
Last Accessed: 22nd November 2013

Shneiderman's Eight Golden Rules of Interface Design. [Online] Available at: http://faculty.washington.edu/jtenenbg/courses/360/f04/sessions/schneidermanGoldenRules.html
Last Accessed: 22nd November 2013

Use of sound in video games. [Online] Available at:
http://matwaite.typepad.com/blog/2011/03/use-of-sound-in-video-games.html
Last Accessed: 22nd November 2013