HCI Undergraduate Project Course

Tablet PC Gaming

Math games for children

TEAM ICE SKATING CAT HUNTERS

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Introduction

- Why Tablet PCs?
  - Using pen as input device
    - Latest hardware in supporting ink based computing
    - Using Tablet PC is similar to using paper and pen
  - Teachers can view kids' scratch work (MathWhiz)

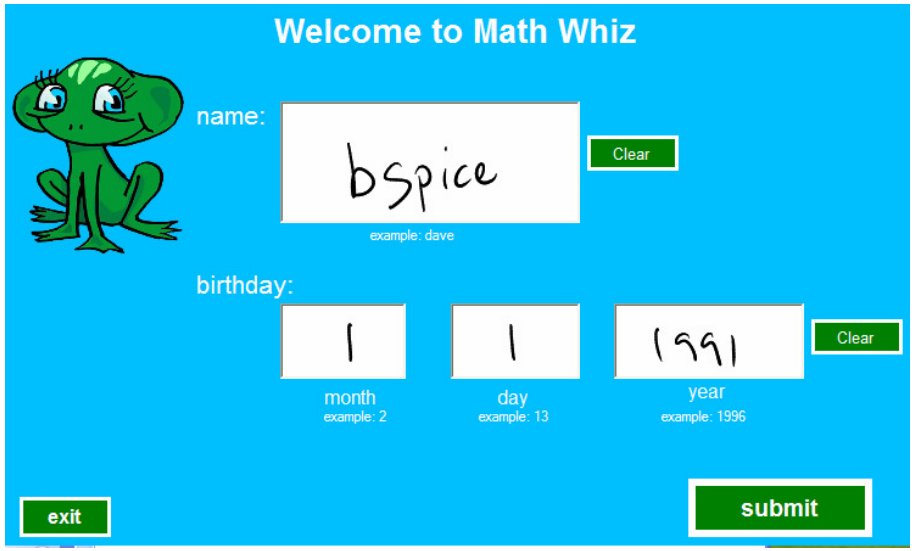
Introduction

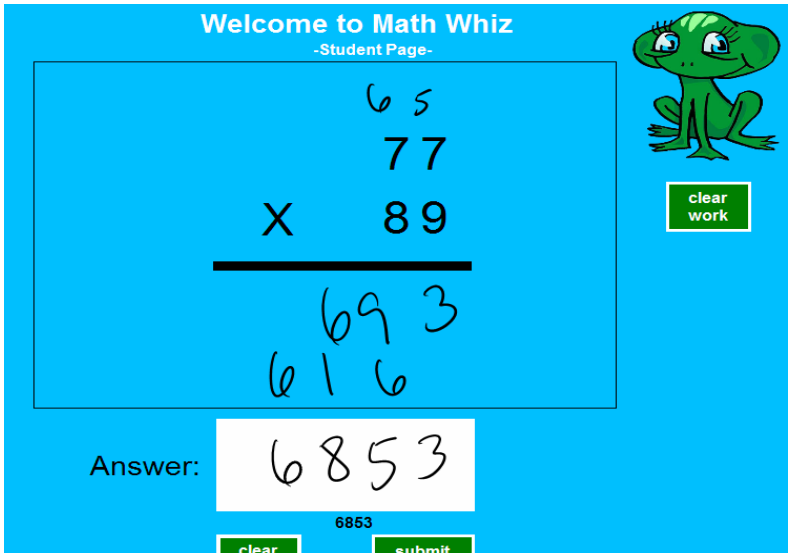
- Why gaming in Education?
  - Lots of interest lately
    - American Federation of Scientists recommend education reform with gaming
    - NSF seems to be interested
      - $$$ for research
    - Integrate gaming into education
      - Very interesting
      - Highly motivating
      - But controversial

References: Federation of American Scientists (http://www.fas.org)

Project History

- Spring of 2006: Junior IS Project (MathWhiz)
  - Integration of Tablet PC front-end with web application for teachers
  - Implemented over the summer to be used in Fall 2006 at Glendale
  - Target users: 4th grade elementary school students



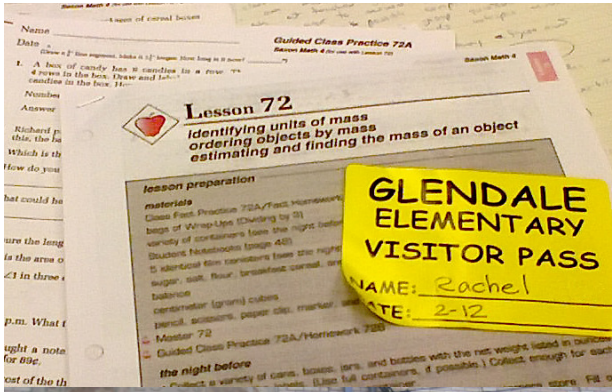


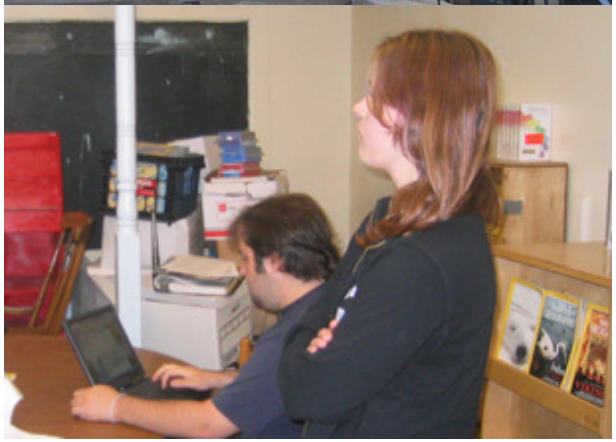
Project History

- Fall 2006: HCI Methods Graduate Project
  - Performed HCI methods to analyze current interface
  - Made suggestions for improvements and additions (such as games)
  - Looked at the usability and overall integration aspect of the Tablet MathWhiz system
  - Recommendations:
    - Personalization
    - Curriculum Integration
    - Gaming

What we've done

- Literature Review
- Research at Glendale
- Affinity Diagram
- Paper Prototyping
- Working Prototype (2 iterations)
- User Testing (2 rounds)
- Final Prototype & Recommendations





Literature Review

- Game should encourage repetition until mastery
  - Provide feedback, cues and hints
- Children are more responsive to:
  - Avatar figures with personality
  - Scenarios / Story-driven games
  - Real-world situations and themes
- Journal/Articles:

- "R&D Challenges in Games for Learning." Federation of American Scientists (2006). 23 Jan. 2007 <http://www.cs.cmu.edu/~ab/HCI-07/R&D_Challenges.pdf>.
- Rieber, Lloyd P. "Seriously Considering Play: Designing Interactive Learning Environments Based on the Blending of Microworlds, Simulations, and Games." Educational Technology Research and Development 44 (2006): 43-56. <http://www.springerlink.com/content/g85t307215n48202/>.
- Klawe, M. M. & Phillips, E. “A classroom study: Electronic games engage children as researches.” Proceedings of Computer Support for Collaborative Learning (1995).
- EGEMS Homepage. Department of Computer Science, UBC. 8 Feb. 2007 <1. http://www.cs.ubc.ca/nest/egems/>.
- Prensky, Marc. Marc Prensky.Com. 9 Feb. 2007 <www.marcprensky.com>.

School Trip - Teacher Interviews

- Major MathWhiz Issues
  - No teacher control/Random order of multiplication tables
  - Initial handwriting problems
- Tablet PCs are only used as a review tool during recess / silent reading times.
  - Teachers follow Saxon math curriculum that isn't very flexible (everything is scripted)
  - Students are rotated for 30 minutes / day
  - MathWhiz only covers multiplication
- Most students enjoy using the Tablet PCs

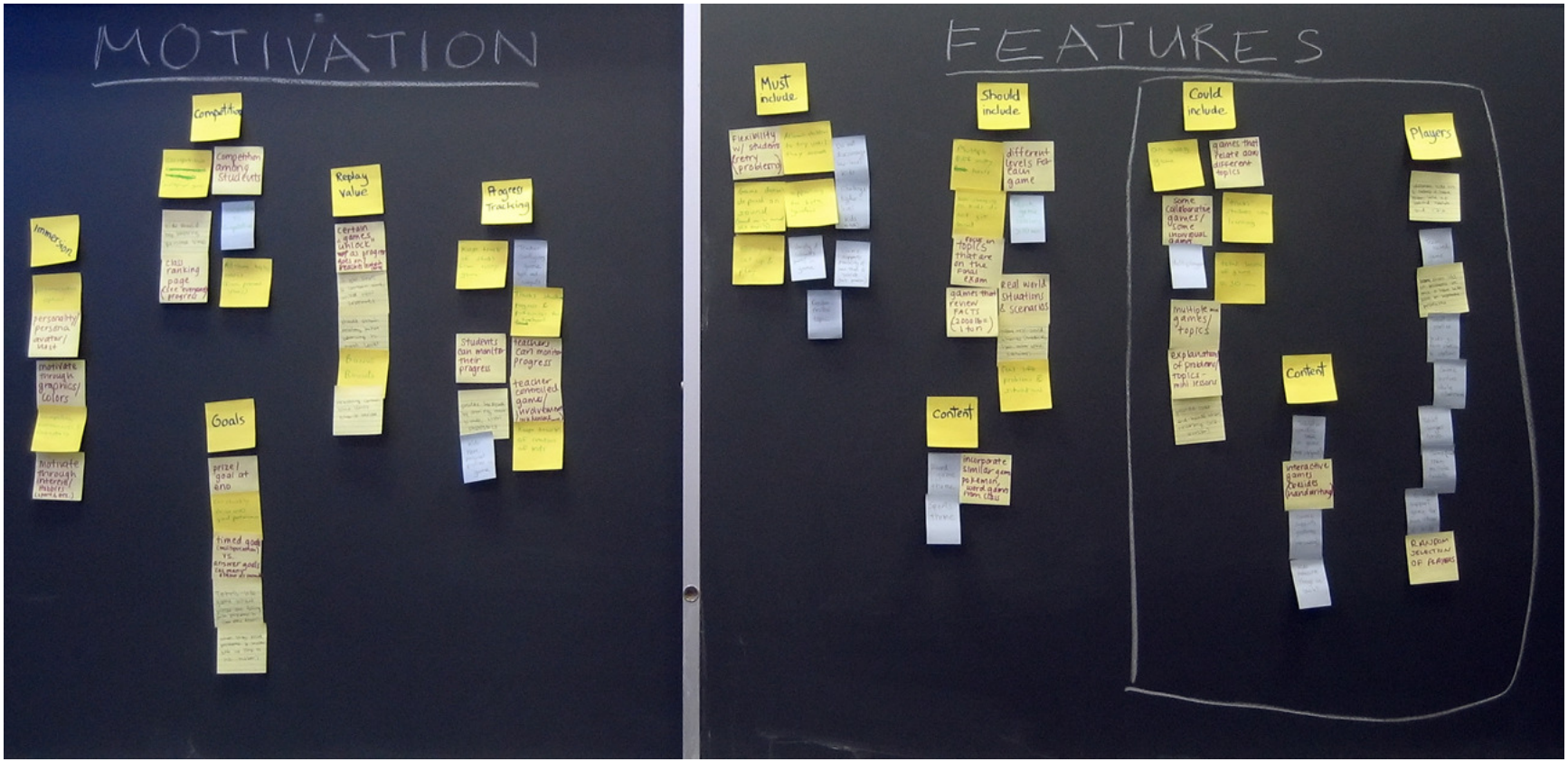
School Trip - Teacher Interviews

- Relevant skills throughout curriculum
  - Multiplication times tables (encourage competition – math race)
  - Graphing / Measuring weight, length, time
  - Probability, decimals, fractions
  - Hardest – elapsed time, 2 digit multiplication, word problems
  - Easiest – area, perimeter, measuring, addition, subtraction
- Some students are competitive
- Use educational games in the classroom
  - Teachers use games because students have low attention spans
  - Get excited in the beginning, but care less as game drags on

School Trip - Observations

- Responded well to:
  - hands-on activities (kids randomly selected to be part of activity)
  - competition (but supportive of each other)
  - visuals (e.g. smartboard)
  - Recognition
- Teacher observations:
  - Always recognizing achievements
  - Avoided singling out students (activities involved at least 3 students)
  - Encouraged further exploration

Affinity Diagram



Must-Include Features

- Allow children to try until they succeed
- Gender-neutral topic
- Easy to set up and play
- Does not require sound
- Game allows less than 6 tablets (in case one is broken)
- Variety of subjects in game
- Do not discourage low-level kids
- Challenge high-level kids

Other Features

- Should include
  - Multiple difficulty levels
  - Quick game sessions
  - Focus on topics on final exam
  - Real world situations / scenarios
- Could include
  - On-going game
  - Some collaborative / some individual
  - Multiple mini-games
  - Explanations of problems
  - Provide cues and hints when necessary

Game Motivation

- Competition
  - Class ranking
  - Try to beat personal times
- Progress-tracking
- Replay value
  - Unlockable features
  - Bonuses
- Immersion
  - Personalization
  - Avatar figures
- Goals

Design Ideas

- Modular game theme (e.g. Mario Party)
- Students choose an avatar with un-lockable features such as color, accessories, etc.
- Each student gets their own tablet, and can choose to play individually or with a partner
- Then they choose an area (times tables, probability)
  - Each area has several levels
- Anonymous comparative ranking amongst class shows how students compare to each other

Finalized Concept

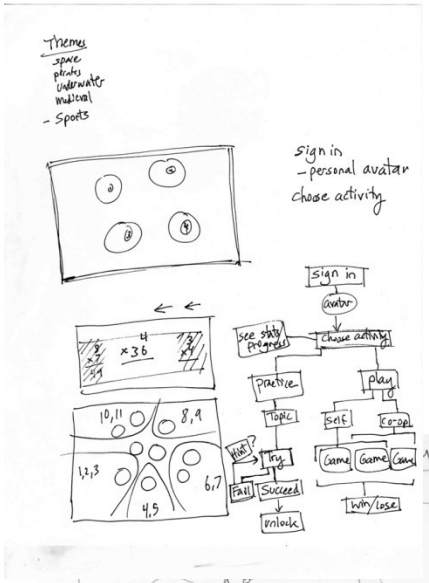
- Finalized Concept
  - Different “practice areas” that relate to different math topics
    - Individual
  - Defeating “practice areas” unlocks bonus games
    - Multiplayer (FFA or Team based)
    - Individual
  - Unique Avatars to motivate students
    - Win games, get money, upgrade avatar
  - Waiting room that displays all avatars
  - Teachers role
    - Will be able to release “areas” to students once they learn that subject
    - Will be able to track students progress

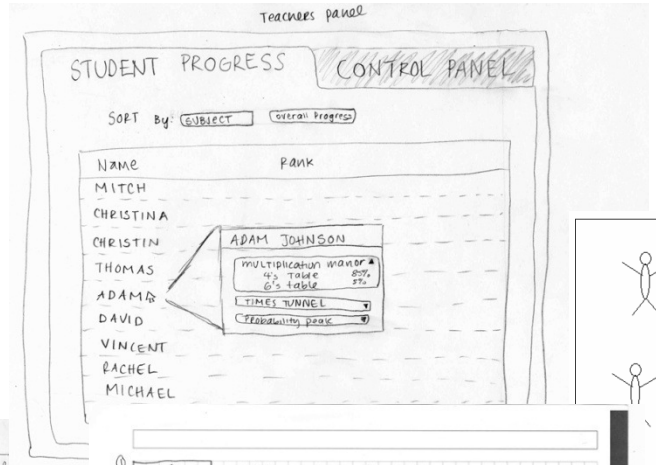
Finalized Scope

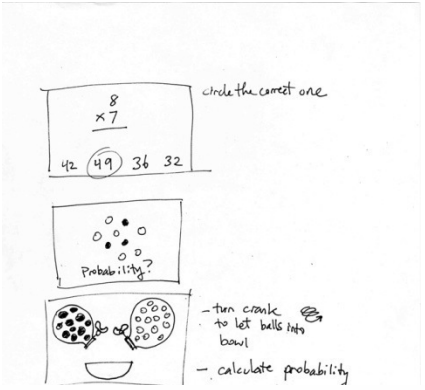
- Scope
  - Framework, one game in one “area”, one bonus game
  - Handwriting recognition too complex to implement
  - Unable to test if game actually improves math skills
    - Need more time
    - Most likely will be used as a review tool
  - Goal is to motivate kids to want to play game

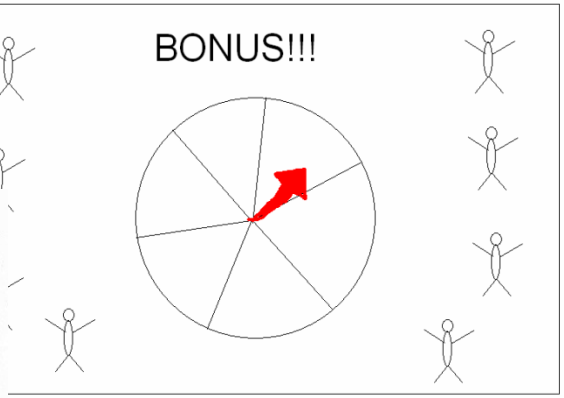
Work Flow

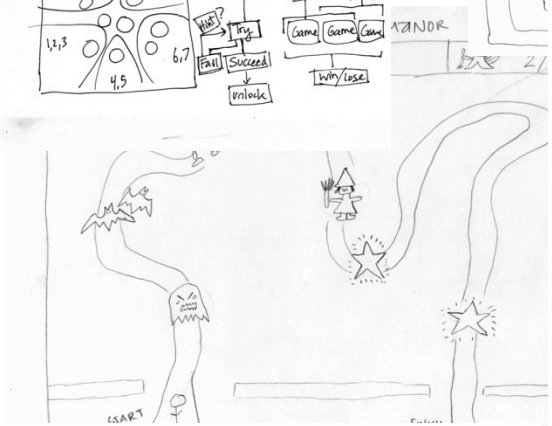
Initial Sketches

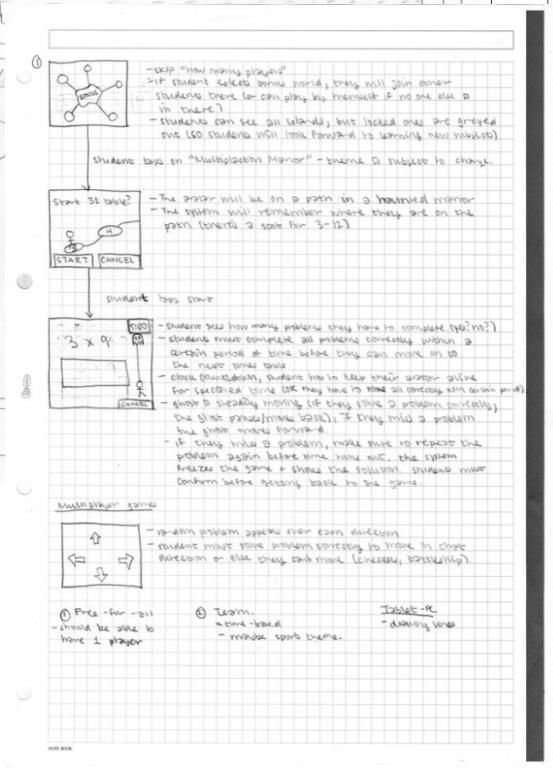


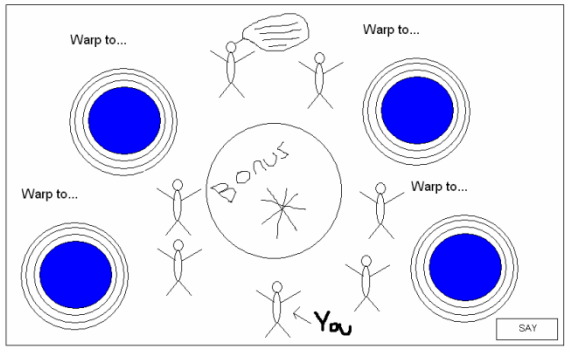


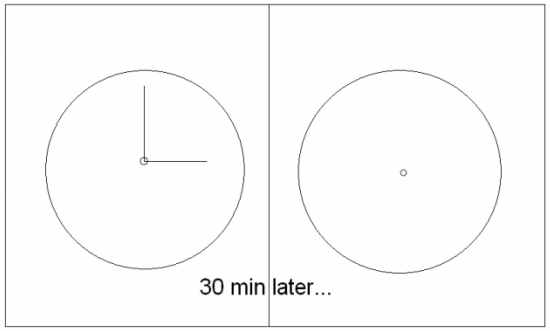












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