

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
- Project History
- Research
- Affinity Diagram
- Direction
- Paper Prototype
- Working Prototype & User Testing
- Demo
- Next Steps
- Q & D

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

Welcome to Math Whiz




name:

example: dave

birthday:

<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1991"/>	<input type="button" value="Clear"/>
<small>month example: 2</small>	<small>day example: 13</small>	<small>year example: 1996</small>	

Welcome to Math Whiz
-Student Page-


$$\begin{array}{r} 65 \\ 77 \\ \times 89 \\ \hline 616 \\ 693 \\ \hline 6853 \end{array}$$

Answer:

6853



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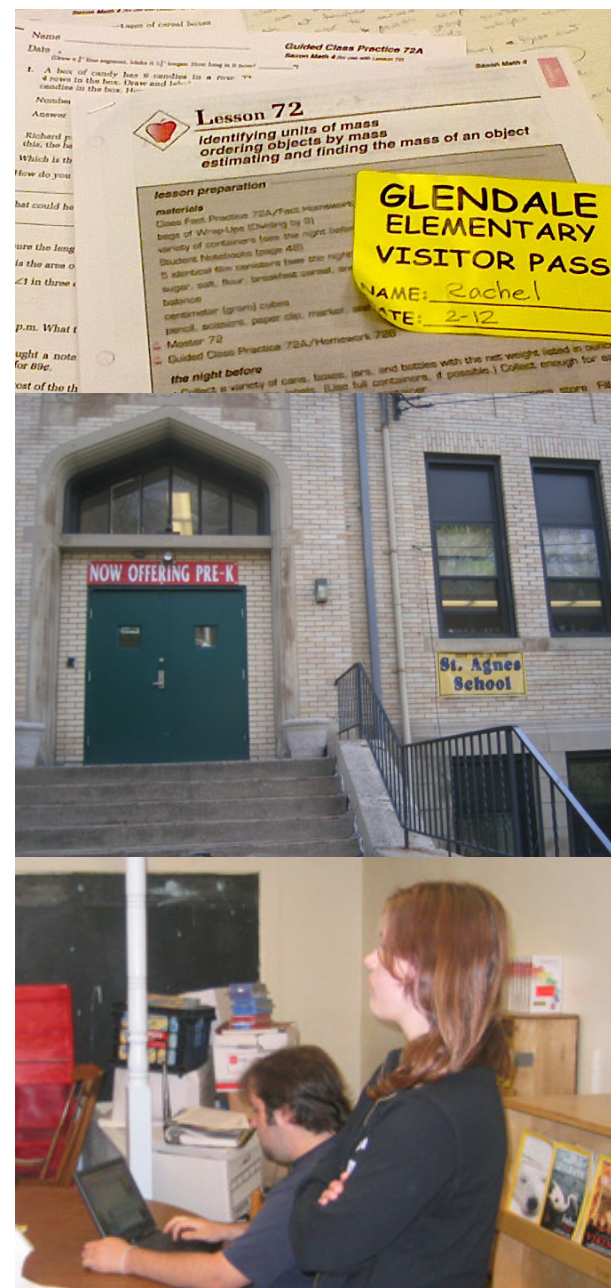
Project History

- 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>.



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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



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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



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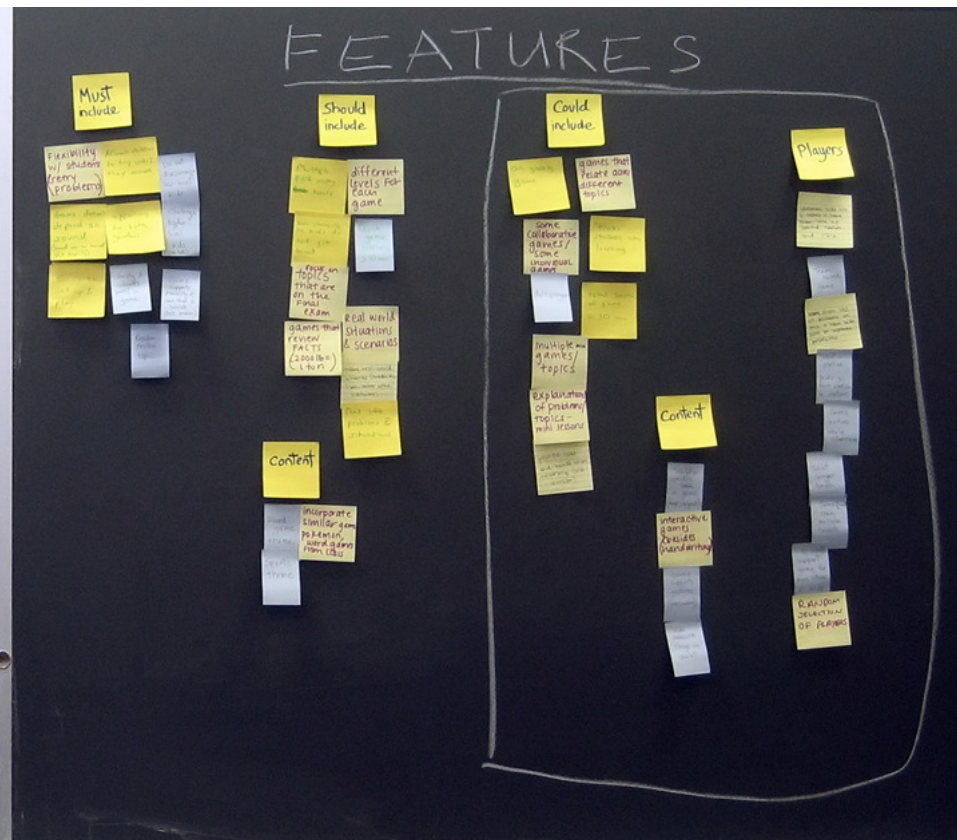
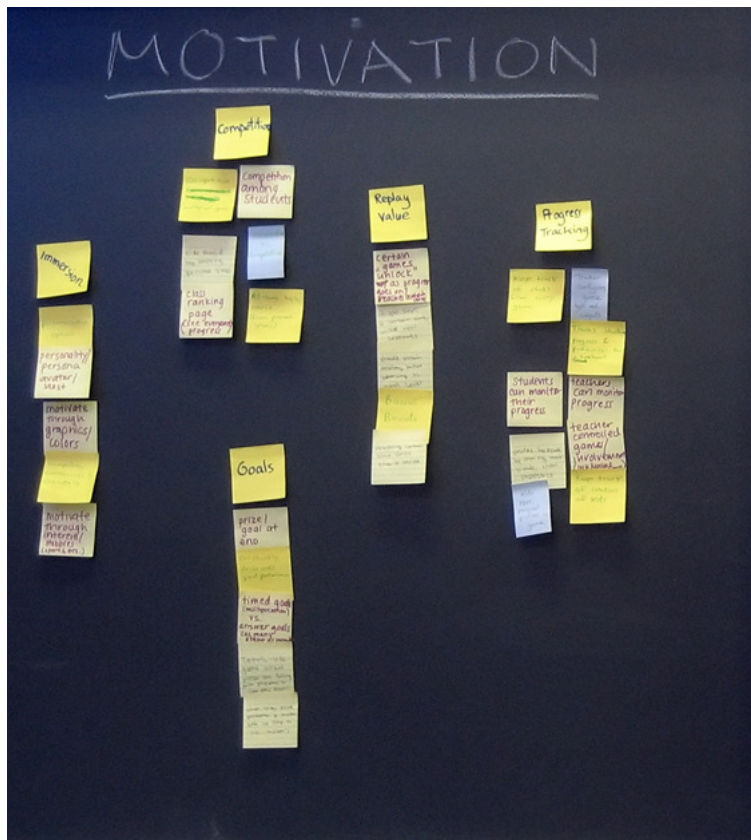
School Trip - Observations

- 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



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Affinity Diagram



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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



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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



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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



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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



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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



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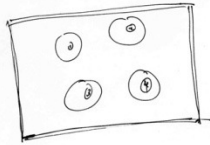
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Work Flow

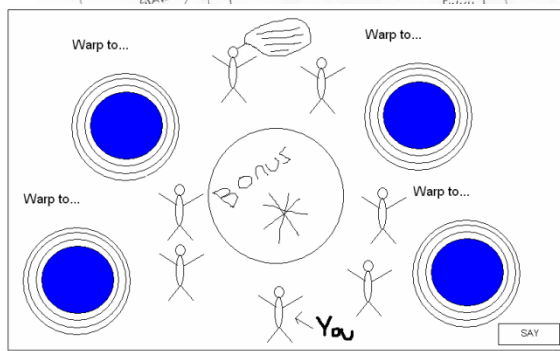
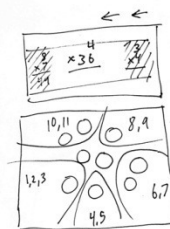


Initial Sketches

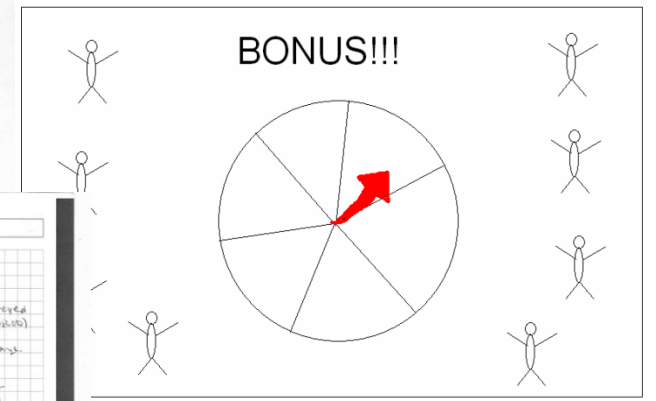
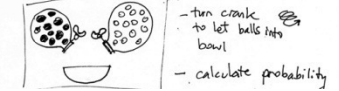
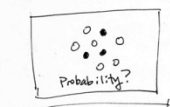
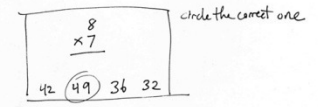
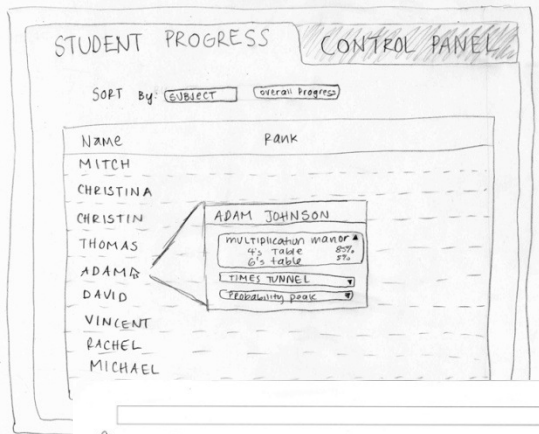
Themes
- space
- planets
- Underwater
- medieval
- Spots



sign in
- personal avatar
choose activity



TEACHERS panel



student base on "Multiplication Manor" - chance to subscribe to change.

Start 36 table?

- The teacher will be in a position in a 'holographic' interface.
- The system will automatically generate sheets and on the spot (convert a spot for 3-12).

student table score

- student will have many problems they have to complete (10-15?)
- students must complete all problems correctly within a certain period of time before being able to go on to the next level table.
- check (automatically) students time to take longer or shorter solving for specific table (OR they may have to time all correctly with a timer panel) groups to start by solving the first table (2 problems correctly) the first problem (round table). If they solve a problem, the game moves forward.
- if taking more than 30 seconds, make sure to repeat the problem (again before time runs out) - the system freezes the game & shows the solution. Students must check them before moving back to the game.

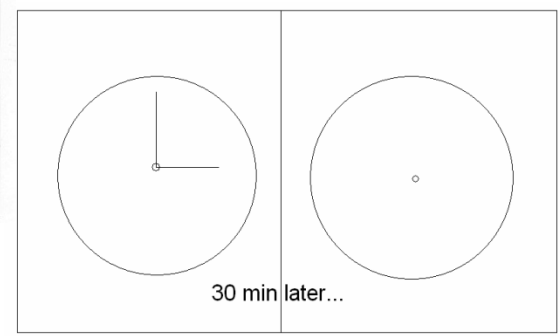
multiplayer game

- in each problem system gives each team a question.
- students must solve problem correctly to move in their direction or else they can move (backward, sideways).

① Free - for all - should be able to have 2 player

② Team - more based - include spots theme.

③ Table - R - drawing table



ERROR: undefined
OFFENDING COMMAND: F'~

STACK: