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

Major MathWhiz Issues

No teacher control/Random order of multiplication tables
Initial handwriting problems
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
ERROR:
OFFENDING COMMAND: f'
STACK:
~,
ERROR: undefined