




Science Learning by Blind Children through Audio-Based Interactive Software

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Outline

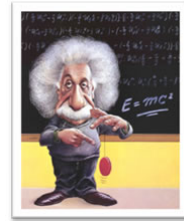
- **Introduction**
- AudioLink
- Cognitive evaluation
- Discussion

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Introduction

- Is science learning
 - Difficult
 - Not appealing
 - **Relevant?**

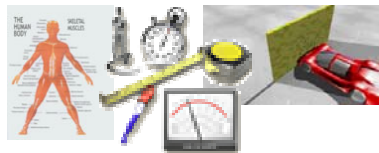


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Introduction

- Blind Children
 - Learn science?
 - Learn science using software?



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Introduction

- **Related work**
 - Educational software for children with visual disabilities using audio
(Kurniawan, et al., 2004; Sánchez & Flores, 2004)
 - Development of mathematics learning and problem-solving skills
(Shaftel et al. 2005)
 - Significant gains in learning math by blind children
(Eriksson & Gärdenfors, 2004; Mastropieri & Scruggs, 1992; Sánchez & Sáenz, 2006)
 - Audio-based software to enhance science learning?

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AudioLink

- **Role Playing Game (RPG)**

- Quests and side-quests
- 2D navigation model



- **Interaction**

- Actions
- Equipment
- Descriptions
- Additional hints



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Cognitive Evaluation

- **Purpose**

- Develop scientific inquiry thinking skills in blind children
 - Observation, classification and experimentation
- Does *AudioLink* combined with cognitive tasks
 - Promote learning of physics and science concepts?
 - Promote problem-solving skills during application tasks?

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Cognitive Evaluation

- **Methodology**

- Field study
 - *Santa Lucía* School for the blind, Santiago, Chile
 - Participation of two special education teachers expert in vision disorders as facilitators
- Six-months period
 - April to October, 2006.
 - Two evaluations per week
 - 1.45 hrs per session.
- Use of concrete materials and cognitive tasks
- Three processes involved
 - Software exploration
 - Knowledge construction
 - Knowledge application

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Cognitive Evaluation

- **Sample**
 - 7 blind students
 - Ages 8 - 14
 - 3 girls and 4 boys
 - All of them were legally blind
 - “An eye is blind when its corrected visual accuracy is 1/10, or when the sight field is reduced to 20 degrees”.
 - They were familiar with computer interaction through a keyboard
 - They had expressive and comprehensive language skills
 - They could utilize reading and writing systems (Braille or Macro-type)
 - The sample had an IQ score over 70

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Cognitive Evaluation

- **Instruments**
 - *WISC-R*
 - The Wechsler Intelligence Scale for Children-Revised
 - General test of intelligence
 - 13 subtests divided into *verbal* and *performance*.
 - The idea was to determine the child's ability to use practical judgments in social situations of everyday life.
 - Each answer had an assigned score

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Cognitive Evaluation

- Cognitive Tasks
 - *Task 1: Little Researchers*
 - Board game
 - Monopoly game metaphor
 - 3 sessions



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Cognitive Evaluation

- Cognitive Tasks
 - *Task 2: Thinking as Scientists*
 - Building the relief puzzle of the world embedded in *AudioLink* by using concrete materials
 - Solving a problem → get a new piece



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Cognitive Evaluation

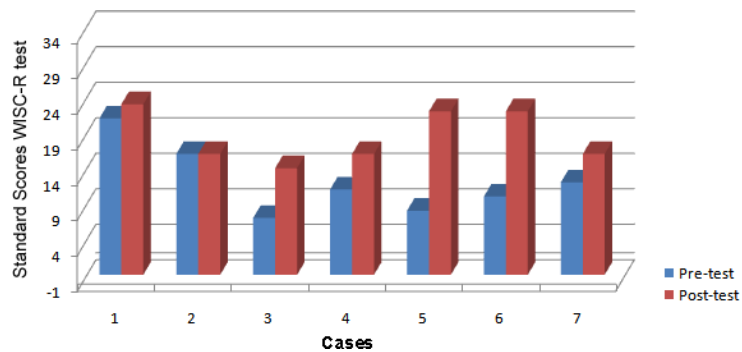
- Procedure
 - Pretest evaluation
 - The WISC-R test was applied.
 - Cognitive tasks
 - Interaction with *AudioLink*
 - Presentation and interaction with concrete materials
 - Team formation, setting ground rules
 - Application and evaluation of the cognitive tasks (Task 1 and Task 2)
 - Posttest evaluation
 - The WISC-R test was applied.

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Cognitive Evaluation

- Results



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Discussion

- When utilizing *AudioLink* together with cognitive tasks, blind students:
 - Faced a new way of gathering science-related information
 - Participated in several activities that motivated them to process, select, and use information purposely
 - A significant positive effect of the performance of these activities on most participants was observed
 - Some of them almost doubled and tripled their performance
 - They increased the number of answers provided as well as their correctness
 - They learned to identify, select and apply different information to solve a given problem

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Discussion

- Children learned scientific facts and processes
 - In a playful way
 - Using analytical skills
 - Classifying, relating, analyzing and comparing
 - Applying critical skills
 - Evaluating and discerning

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Discussion

- We observed improvements in
 - The psychomotor area
 - How learners explored and manipulated concrete materials
 - The cognitive area
 - They showed an appropriate degree of comprehension of the game structure and rules
 - How children recognized information and applied knowledge
 - The affective area
 - Students were encouraged and willing to participate
 - Aware of their errors and asking for help when needed

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Discussion

- *AudioLink*, as multimedia audio-based tool, combined with cognitive activities can be used to
 - Support the development of some of the core scientific inquiry thinking skills
 - Enhances problem solving skills
 - Through experimentation
 - Using the scientific method.
 - Implements an appealing and encouraging way to
 - Learn science content
 - To develop scientific thinking skills

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Introduction

- Edutainment
 - Kids prefer playing
 - Engagement
 - Involvement
 - Motivation
 - Meaningful learning
 - New possibilities
 - New challenges



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Edutainment

- Learning through games
 - Problem-solving skills (Shaftel, J., Pass, L., Schnabel, S. (2005). Math Games for Adolescents. Teaching Exceptional Children, 37(3), 25-30)
 - Design new strategies
 - Logical reasoning
 - Develop skills
 - Attention to task
 - Social
 - Practice what was learned over and over again, making mistakes



Interactive Software

- Software development environment
 - Windows
 - Macromedia Director MX
 - External Libraries
 - DirectSound Xtra
 - Dom Lingo
 - Macromedia Fireworks
 - Wavepad



Interactive Software

- Requirements
 - PIV (or similar) CPU, 1.8 Ghz
 - 512 MB RAM
 - 300 MB of free hard disk
 - 5.1 Sound Blaster (or similar) soundcard
 - Windows XP o 2000
 - Microphone