

# **Adapting Tablet PC Technology as a Support for Students Who are Deaf or Hard of Hearing**

Lisa Elliot ♦ Pamela Francis ♦ Michael Stinson  
Anne Alepoudakis ♦ Donna Easton

National Technical Institute for the Deaf  
Rochester Institute of Technology

Presented at An International Symposium: Technology and Education of the Deaf  
June 24, 2008 – Rochester, New York

# Overview

- Description of research
  - Grants
  - Goals
  - Rationale
- Demonstration of technology
- Lessons learned
- Questions and answers



# Research Grants Funded

- Using a Tablet PC and C-Print to Support Deaf and Hard-of-Hearing Students
  - U.S. Department of Education, 09/05-08/08
- Evaluation of the Use of Tablet PCs and C-Print to Support Deaf and Hard-of-Hearing Students
  - U.S. Department of Education, 09/07-08/10

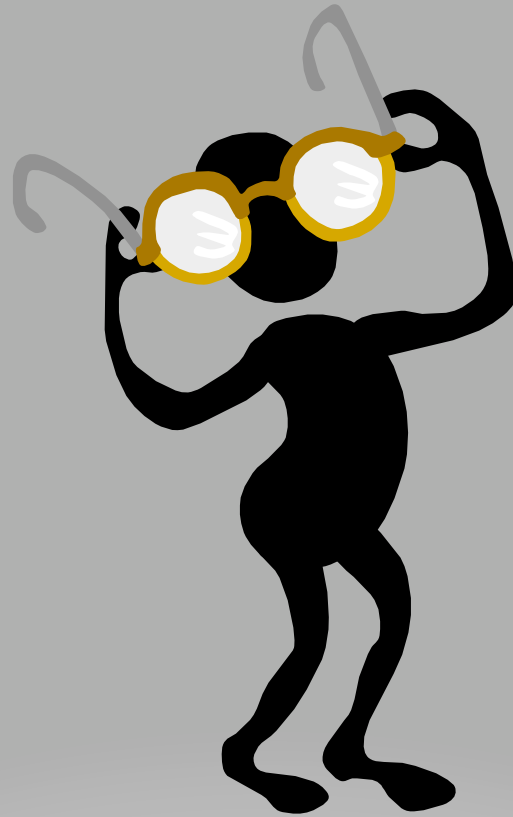
# Challenges in STEM Classes

- Students with hearing loss experience challenges in STEM classes due to:
  - Popular teaching strategies in STEM classes
  - Properties of standard laptop computers
  - Available speech-to-text software created to capture verbal exchanges

# Research and Development Goals



- Implement two options for using tablet PCs to provide support services for deaf/hard-of-hearing (d/hh) students
  - Provide real-time notetaking support (handwritten)
  - Provide graphic information along with a real-time display of text



**A Quick Look**

# Initial Research Study

- Using a Tablet PC and C-Print to Support Deaf and Hard-of-Hearing Students
  - 15 deaf/hard-of-hearing students participated in the initial study; as well as their classroom teachers, itinerant or resource teachers, and C-Print captionists or notetakers
  - All students were enrolled in general education classrooms
  - 5-week trials

# Student Characteristics

## Real-time Notetaking Trials

<i>Sub #</i>	<i>Sex</i>	<i>Grade</i>	<i>Read Level</i>	<i>Btr Ear HL</i>	<i>Course</i>	<i>Additional Support Services Received Prior to/During Trial</i>			
						<i>Interp</i>	<i>Note-taker</i>	<i>FM</i>	<i>C-Print</i>
001	M	7	7.9	M→Sev	Science	√		√	
002	F	10	>16.9	Mod	Chemistry		√	√	
003	F	10	8.6	Mild	Geometry		√	√	
004	F	8	13.7	Mod	Math		√	√	
005	F	9	15.5	Mod	Math			√	
006	M	7	6.9	M→Sev	Math		√	√	
007	F	11	5.0	Sev	Algebra	√	√		



# Student Characteristics

## Tablet C-Print Trials

<i>Sub #</i>	<i>Sex</i>	<i>Grade</i>	<i>Read Level</i>	<i>Btr Ear HL</i>	<i>Course</i>	<i>Additional Support Services Received Prior to/During Trial</i>			
						<i>Interp</i>	<i>Note-taker</i>	<i>FM</i>	<i>C-Print</i>
008	M	8	12.9	Sev	Math	√	√	√	
009	F	7	9.0	Prof	Science	√	√		
010	M	11	16.2	Mild	Math				√
011	M	11	>16.9	Mod	Pre-Calculus				√
012	M	7	13.3	Mod (CI)	Science	√	√		
013	F	11	>16.9	Mod	Pre-Calculus			√	√
014	F	10	7.1	Mod	Algebra				
015	M	11	6.9	Mild	Chemistry				

# Student Feedback

*Student describes her usual experience with the pen-and-paper notetaking service:*

“Well, from the notes on the paper, the way you get them at the end of the day, we have no idea what they wrote. If you see that they wrote something it is kind of like, you don’t need that. Well not that you don’t need it, but like but if they like didn’t get something that you really, really needed, and like, later that night and you need to know what it is but you didn’t get to write it down yourself, you might look back on the notes and it is not there and is really frustrating.”

# Student Feedback

*Student comments on her experience with the tablet captioning with graphics:*

“I thought that was really cool! It was like a mini version, and I was writing on it and um, I like seeing C. (captionist) writing on the teachers notes and then that way I can add to them myself, and also when I got the notes at home I could have my own notes but I could have C.’s notes too. “

# Preliminary Results

Teacher Ratings of Student Performance During Tablet Trial  
As Compared to Student Performance Without Tablet

Sub #	Much less than avg performance	Less than avg performance	Avg performance (no difference)	Better than avg performance	Much better than avg performance
001	<b>A</b>			<b>V</b>	<b>P</b>
002			<b>AVP</b>		
003					<b>AVP</b>
004			<b>V</b>	<b>AP</b>	
005			<b>VP</b>	<b>A</b>	
006			<b>AVP</b>		
007			<b>AVP</b>		
008			<b>V</b>	<b>AP</b>	
009			<b>V</b>	<b>A</b>	<b>P</b>
010				<b>AVP</b>	
011			<b>AP</b>	<b>V</b>	
012			<b>A</b>	<b>VP</b>	
013			<b>AVP</b>		
014			<b>V</b>	<b>AP</b>	
015			<b>V</b>	<b>AP</b>	

A= Academic Achievement

V= Learning New Vocabulary

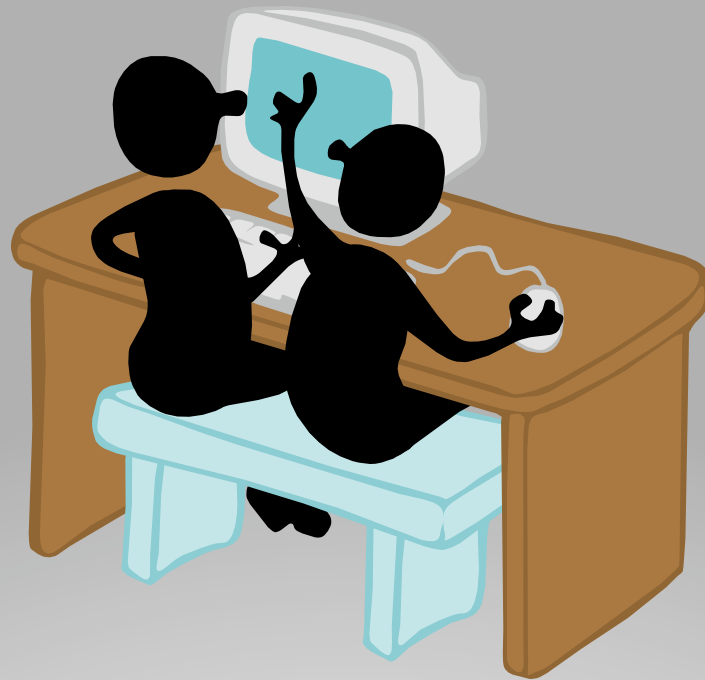
P= Class Participation

# Teacher Feedback

*Teacher comments about change in student behavior related to class participation during trial:*

“Yeah, in terms of her participation, she is a very strong student to begin with and she obviously takes pride in her work. But it seemed like her participation now is less on, "I don't understand this", but more on "I just want to repeat and want clarification". So her participation though, may not have improved in terms of how many times she was speaking out, but the information she was presenting to the class was more on target than before.”

# Demonstration



# Common Features

- Tablet PCs
- C-Print Pro™ tablet software
  - Allow a range of ways to produce information, from text to drawing
  - Different from previous version of C-Print Pro software and other speech-to-text services that produce only text
- Notes distribution
  - Can be distributed in various formats (i.e., .html, .pdf, .doc)

# Real-time Notetaking

The screenshot shows a digital drawing application window titled "Server Drawing Booklet". The window contains a grid background with handwritten mathematical content. At the top left, it says "A) page 2". In the center, a coordinate plane shows two intersecting lines: a red line labeled  $y = 2x + 1$  and a green line labeled  $y = 4x - 3$ . Their intersection point is marked with a dot and labeled  $(2, 5)$ . Below the graph, the text "REMEMBER - CHECK YOUR WORK" is highlighted in yellow. Underneath, there are two columns of calculations. The left column, in red, shows the substitution of  $x = 2$  into the red equation:  $y = 2x + 1$ ,  $5 = 2(2) + 1$ ,  $5 = 4 + 1$ , and  $5 = 5$  with a checkmark. The right column, in green, shows the substitution of  $x = 2$  into the green equation:  $y = 4x - 3$ ,  $5 = 4(2) - 3$ ,  $5 = 8 - 3$ , and  $5 = 5$  with a checkmark. At the bottom of the window, there is a navigation bar with the text "<< 6 of 8 >>".

A) page 2

$y = 2x + 1$

$y = 4x - 3$

$(2, 5)$

**REMEMBER - CHECK YOUR WORK**

$y = 2x + 1$	$y = 4x - 3$
$5 = 2(2) + 1$	$5 = 4(2) - 3$
$5 = 4 + 1$	$5 = 8 - 3$
$5 = 5$ ✓	$5 = 5$ ✓

<< 6 of 8 >>



# Impact on Role of Notetaker

- Become more familiar with technology
- Be more “synchronized” with presentation of information
- Write clearly/legibly
- Interact with students
- Manage schedule demands

# Speech-to-Text with Graphics

C-Print Pro Server - sample 1.cps

Server Drawing Booklet

So what would co mean? It means together, shared. So covalent bonding means?

**Student:** Sharing electrons.

**Teacher:** Right. Instead of giving electrons, the atoms share them.

**Covalent bonding** is bonding which occurs when atoms share electrons.

For covalent bonding we make something called an electron dot diagram. (see drawing booklet)

The number of covalent bonds equals the number of electrons needed to make a complete outer shell.

A small part of a compound is called a molecule. A molecule is the smallest part of a covalently bonded compound with the properties of that compound.

Cl ··· Cl

↑  
shared electrons

Another way to show the covalent bond is Cl-Cl

00:00:00 Active Dictionaries: ProBasic -, Priority: 1 Edit

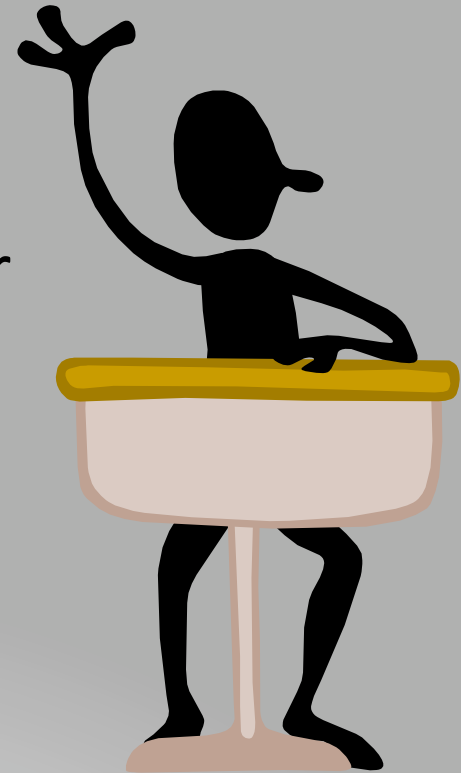
<< 1 of 1 >>

## Impact on Role of Captionist

- Manage multiple sources of input
- Become more technologically “savvy” (more training)
- Encourage student to self advocate and be more involved
- Facilitate more of a team approach with classroom teachers and students
- Adapt editing process and distribute files differently

# Student

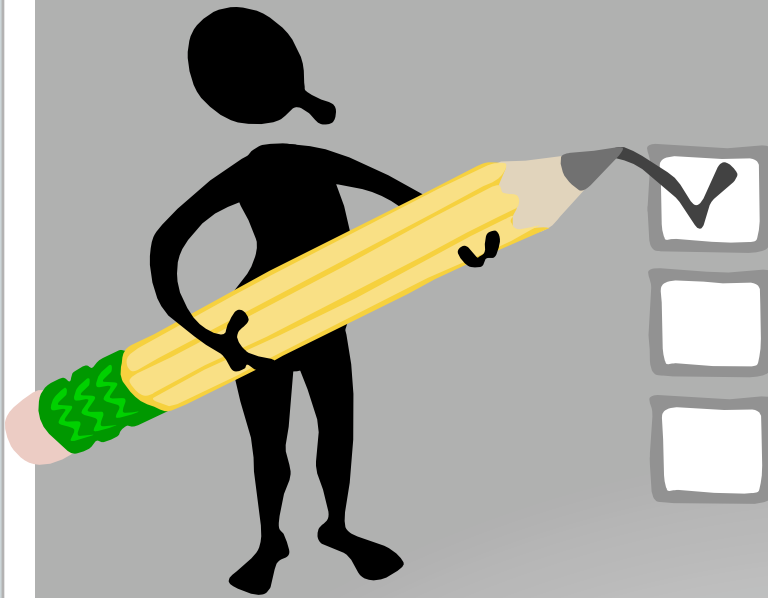
- Taking notes for themselves
- Communication with service provider
- Adapting to new technology
- Individualized



# Impact on Role of Student

- Develop comfort level with technology
- Interact with service provider
- Manage visuals (what to look at and when)
- Get training/support for notetaking skills and use of notes after class

# Conclusion



- Research
- Technology
- Lessons learned
- Questions and answers

# Contact Information

National Technical Institute for the Deaf  
C-Print Research & Development

Phone: 585-475-7557

Fax: 585-475-4454

Email: [cprint@rit.edu](mailto:cprint@rit.edu)

Web: [www.cprint.rit.edu](http://www.cprint.rit.edu)

*Thank you  
for attending  
our session! ✨*

