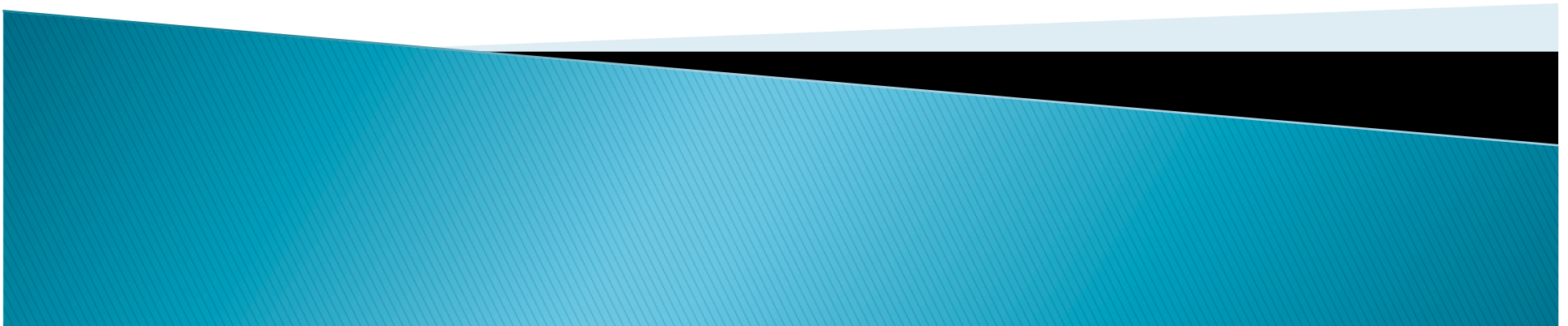


# C2Learn Software:

Utilizing current technology to improve comprehension  
of programming concepts among deaf students

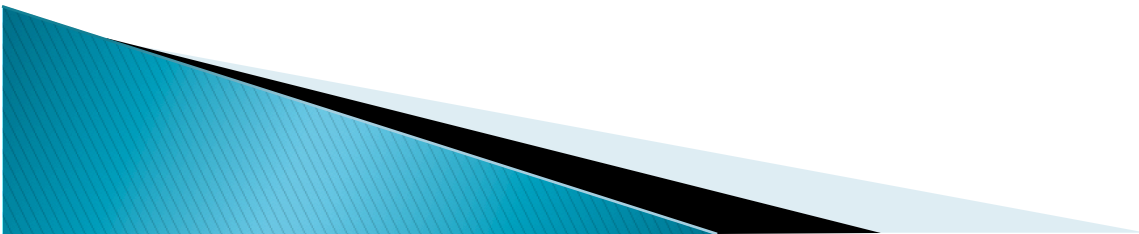
Brian Trager

Joseph Stanislow



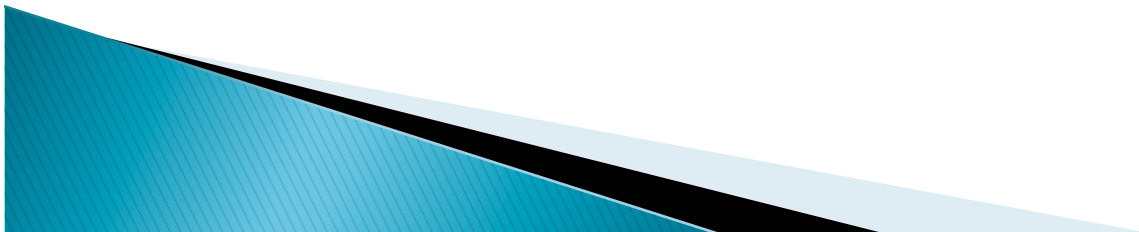
**“Pictures, beside the pleasure they give, act as definers of the text, and convey far more correct ideas than could be gained from words alone.”**

**– James H. Logan (1870)**



# Literature Review

- ▶ Learning Styles
- ▶ Limitations of vision
- ▶ Direct vs. Mediated instruction
- ▶ Instructional Tool Study



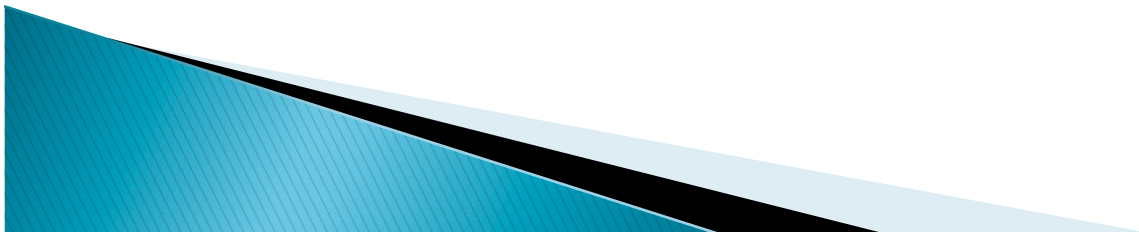
# Learning Styles

- ▶ Three different learning styles
  - auditory, visual, kinesthetic
- ▶ Deaf students –
  - Inherently visual learners due to sensory compensation
- ▶ Visual learners –
  - Want to see the process of how things are done.  
“Can I see that again?”
- ▶ Presentation should show clear demonstrations
  - Concrete examples, graphs, charts, visual representations of abstract concepts



# Limitations of vision

- ▶ Solely rely on vision to gather information
- ▶ Adequate time needed to gather all information
- ▶ Two visual sources of information:
  - Visual presentation (PowerPoint, video without CC)
  - Interpreter or Instructor
- ▶ Regardless of choice, some information will be missing



# Direct vs. Mediated Instruction

## ▶ Direct instruction

- Information from an instructional source is presented directly to the audience

## ▶ Mediated instruction

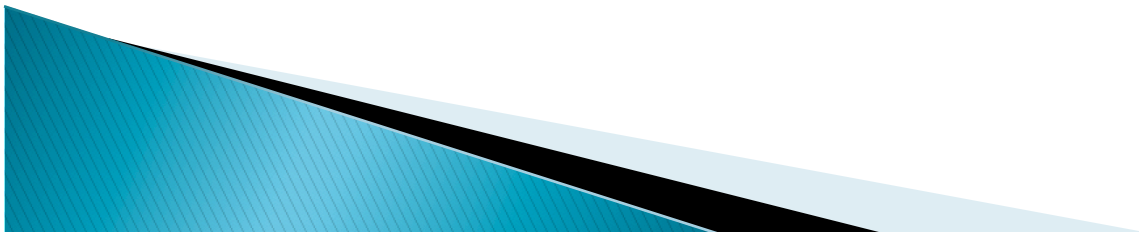
- Information is presented through an interpreter
- Usually in mainstream environment

## ▶ Comprehension test of lecture content (Marschark & Sapere, 2004)

- Highly qualified interpreter provided
- Deaf students consistently scored lower than hearing peers

## ▶ Access services are not at fault

- Direct instruction cannot be replicated with mediated instruction even under optimal conditions



# Instructional Tool Study

- ▶ Study conducted by Dowaliby and Lang (1999)
- ▶ Various multimedia strategies examined
- ▶ 11 lessons on the human eye
- ▶ 144 deaf participants
  - Split into three categories based on their reading skills (low, middle, high)



# Instructional Tool Study – Cont'd

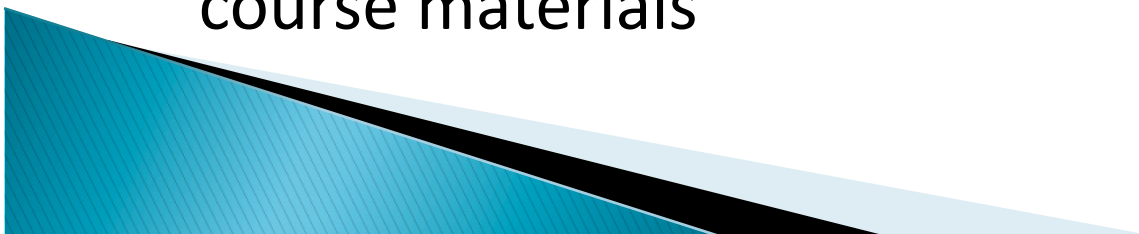
- ▶ Comparison of scores (maximum of 11 points)
  - Text only
    - Low: 5.6
    - Middle: 7.5
    - High: 8.2
  - Combination of text reading, content video, sign video, and adjunct questions
    - Low: 8.4
    - Middle: 10
    - High 10.4
- ▶ An average of 2.4 points increase with instructional tool
- ▶ Adjunct questions alone proved to be the most effective in improving scores





# Conclusion of Literature Review

- ▶ Mediated instruction in classroom not optimal for deaf students
- ▶ A learning tool can be beneficial to deaf students without changing current method of instruction in the classroom
- ▶ C2Learn software should not be perceived as a “magic wand”
- ▶ It could be ideal to use it as a supplemental tool to course materials



# Learning Tool Application

- ▶ User-driven application
- ▶ Four modules: focuses on decisions and advanced decisions in Java
- ▶ Average of 12 slides for each module
- ▶ 50+ minutes of video
- ▶ 30+ adjunct questions
- ▶ 10+ animated examples



# Methodology

- ▶ Pilot study undertaken to investigate the effectiveness of the C2Learn software
- ▶ Participants – Deaf and hard-of-hearing IT students registered in introductory programming courses
  - 14 students registered
  - 9 students were part of the study



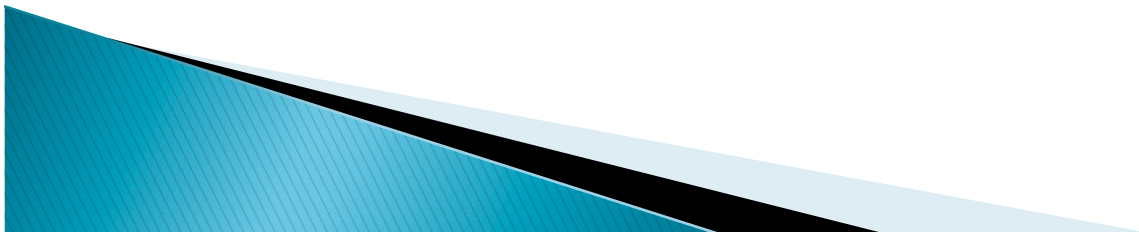
# Methodology – Cont'd.

- ▶ Test #1 – Administered before C2Learn software was given to participants
- ▶ Learning Tool – Participants were informed to start with if statement module
- ▶ Test #2 – Administered when participants completed all modules in C2Learn software
- ▶ Learning Tool Survey – Inquire thoughts and gather feedback



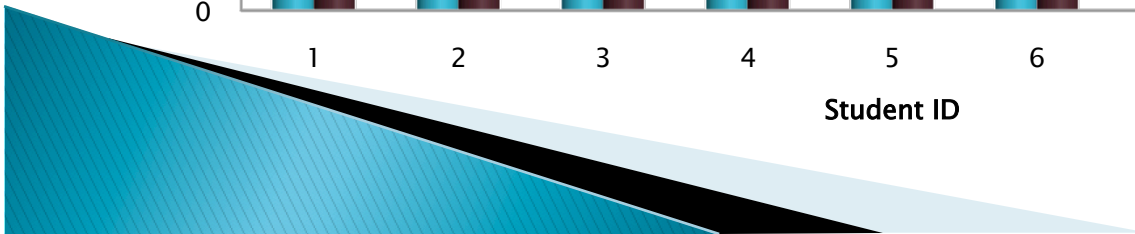
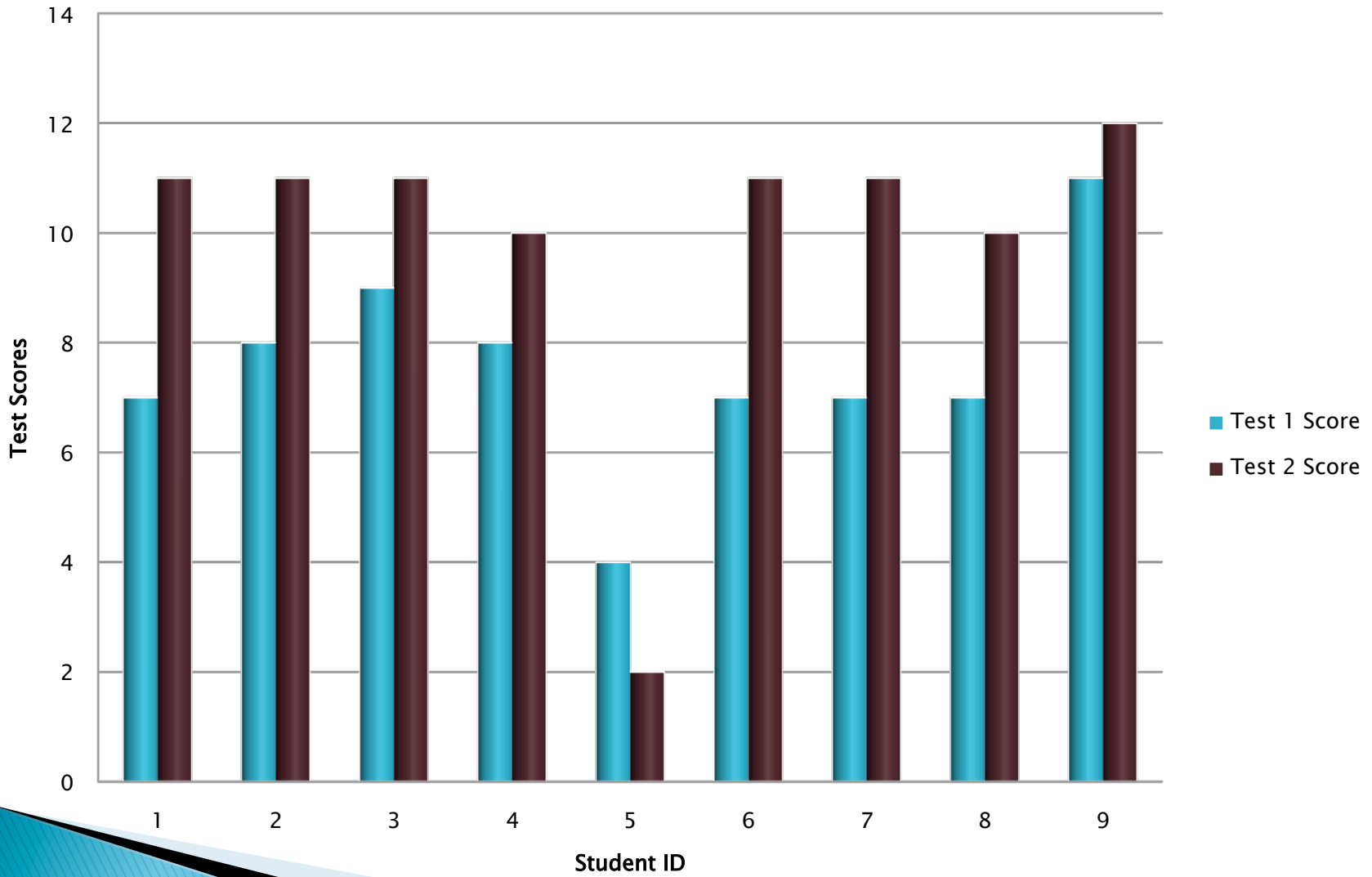
# Test Results

- ▶ Each test has 14 questions
- ▶ One point is given for each question that is answered correctly
- ▶ A combination of multiple-choice questions and fill-in-the-blanks



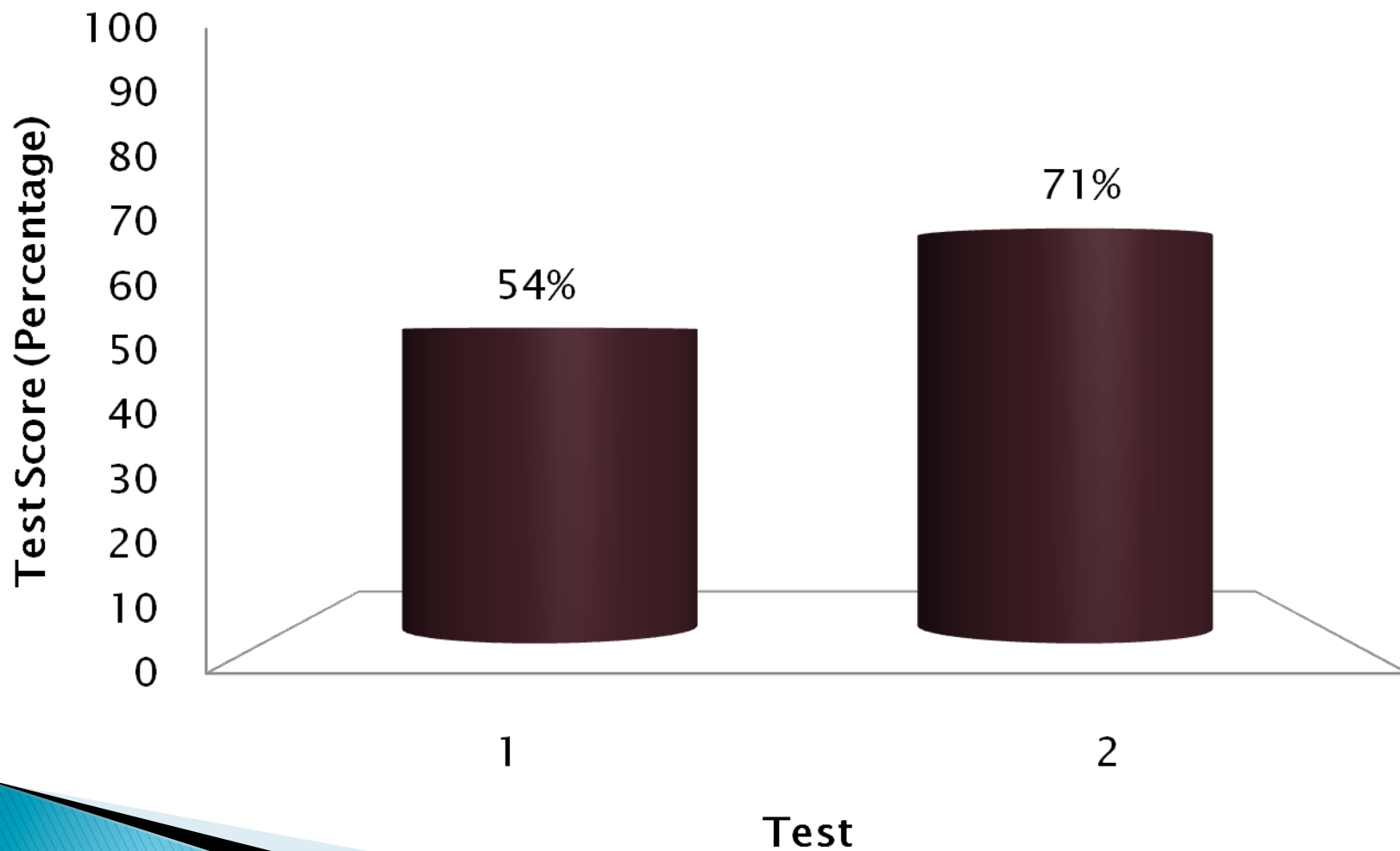
# Comparison of preliminary and post test scores among participants

## Individual Test Scores



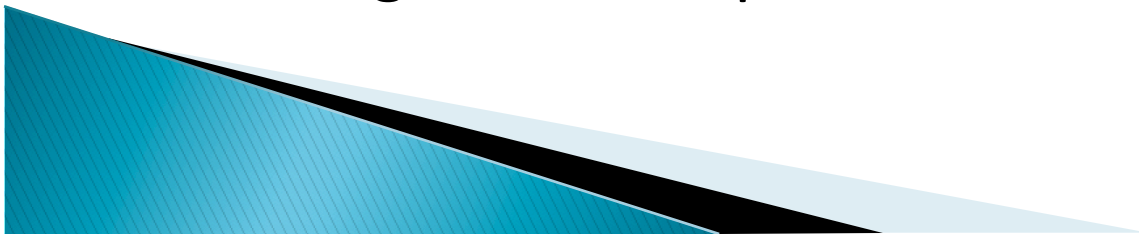
## Comparison of average test scores (percentage) among participants

### Average Percentage



# Test Results Conclusion

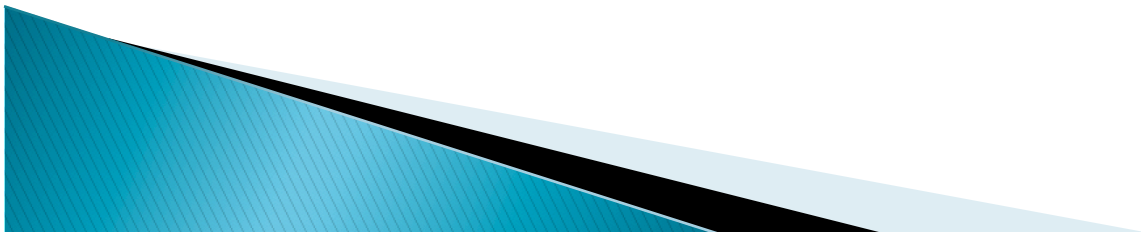
- ▶ 8 out of 9 students scored better on the second test
  - One participant had worse score on post-test
  - Spent less than 20 minutes with learning tool
- ▶ Other participants averaged 75 minutes
- ▶ Average of 2.33 point increase on post-test
- ▶ Average score on pre-test: 54%
- ▶ Average score on post-test: 71%





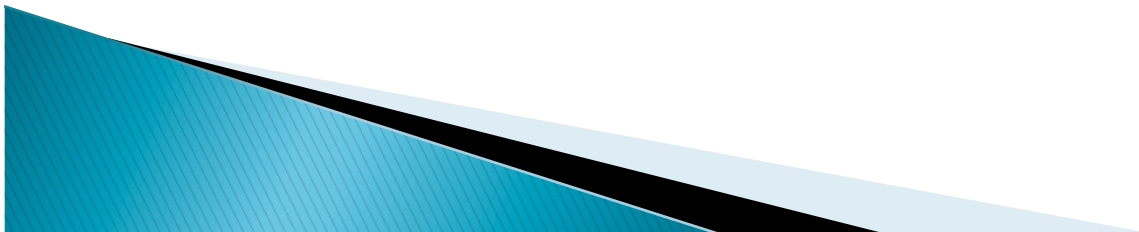
# Conclusion

- ▶ C2Learn software proved to be effective in improving comprehension
- ▶ A 17% increase in average score (21% excluding student 5)
- ▶ 8 out of 9 showed improvement on the second test
- ▶ C2Learn Software demonstration

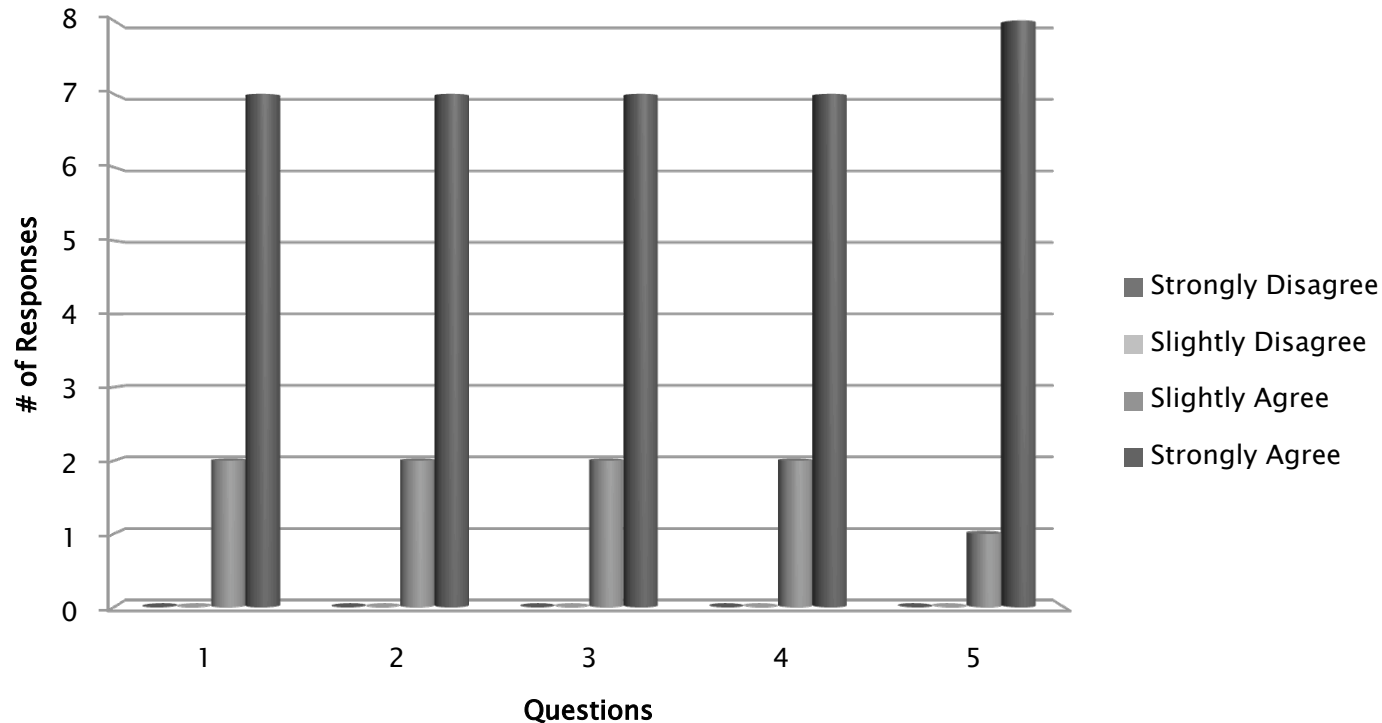


# Learning Tool Survey

- ▶ Nine questions were rated in Likert Scale
- ▶ Likert scale ranged from 1 to 4
  - 1 represents strongly disagree
  - 4 represents strongly agree
- ▶ Neutral evaluations eliminated
- ▶ Four open-ended questions to gather feedback

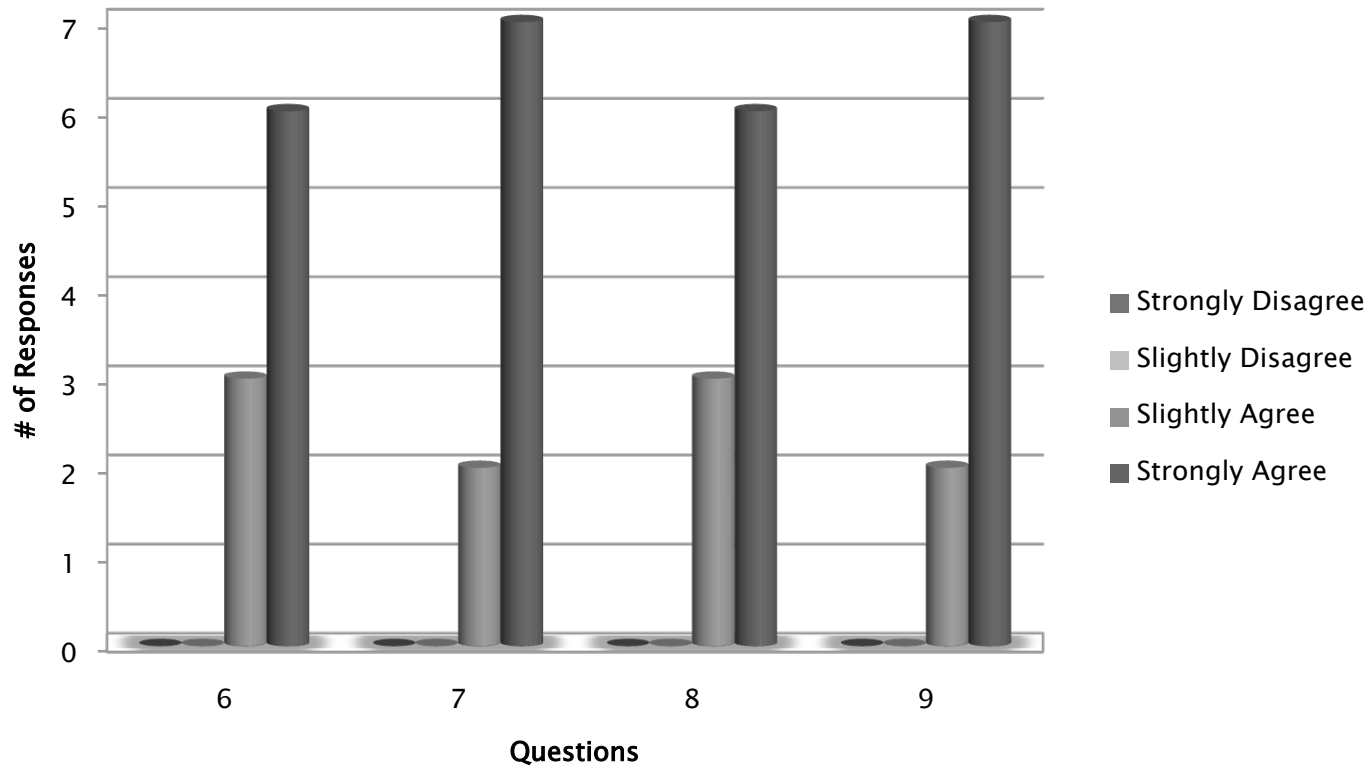


## Learning Tool Survey Chart



- ▶ Q1: Overall the program on the CD is an excellent learning tool.
- ▶ Q2: I am satisfied with the scope of information presented.
- ▶ Q3: I am satisfied with the quality of the content presented.
- ▶ Q4: I would prefer to use this tool in conjunction with the textbook.
- ▶ Q5: The examples helped me understand the concepts better.

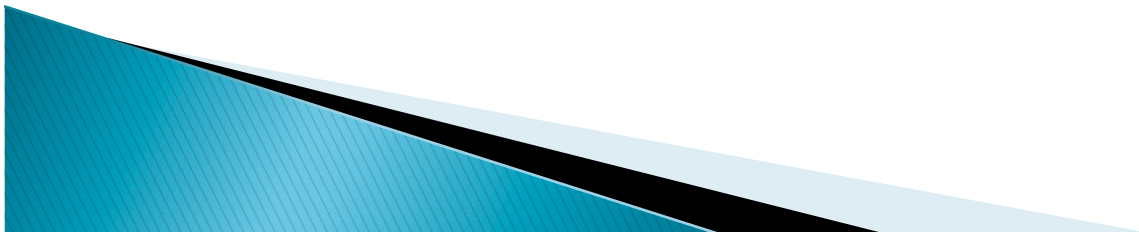
## Learning Tool Survey Chart



- ▶ Q6: The questions helped reinforced what I just learned.
- ▶ Q7: The content clearly presented the concepts in Java.
- ▶ Q8: The video in the program helped me understand the concepts better.
- ▶ Q9: I would use this program again.

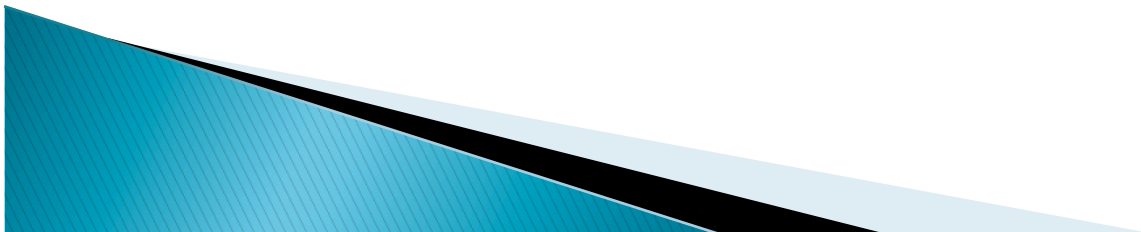
# Survey Results

- ▶ What was the most effective part of the learning tool?
  - By giving true examples and providing students with multiple choice questions
  - Now I understand the part in switch statements and else-if statements better
  - The animation part. I like to see an example of output in conjunction with the given statements
  - The part regarding animations was most effective because I was able to see the actual process of applying the new concepts being taught



# Survey Results

- ▶ What was the least effective part of the learning tool?
  - Slow loading times and some bugs were detected
  - Could use more multiple choice questions
  - The animations were a little slow
  - There were not enough lessons
  - The animations ran too slow for a person who understands quickly.



# Survey Results

- ▶ What improvements should be made to enhance your experience with the learning tool?
  - Add more advanced coding (complex concepts)
  - More animations of examples
  - Add a blank box of some kind for students to input and test out their codes
  - Animation speed adjuster
  - Videos should run in conjunction with the animated examples and text statements



# Survey Results

- ▶ Would you recommend the learning tool to others?  
Why or why not?
  - Definitely. It is very interactive and easy to follow. It allows you to be on your pace and allows you to go back to where you want to reread something.
  - Yes, because it will help others understand better.
  - I would recommend this CD to others because it is like a virtual classroom and the concepts presented by the CD was easy to grasp due to well-organized presentation.
  - It would help others to master Java effectively

